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ORIGINAL COMMUNICATIONS.

ON AN ACOUSTIC PHENOMENON NOTICED IN A CROOKES TUBE.[1]

BY CHARLES R. CROSS.

A SHORT time since, while experimenting with a Crookes tube, I noticed a phenomenon which was quite striking, and so evident that it hardly seems possible that it has not frequently been observed before; but as no allusion to the effect in question has come to my notice, I venture to call attention to it.

In working with the tube in which a piece of sheet platinum is rendered incandescent by the concentration upon it of electrified particles, repelled from a concave mirror, I noticed that when the mirror was made the negative electrode, so that this concentration took place, a clear and quite musical note issued from the tube. I thought at first that the pitch of the note would coincide with that produced by the circuit-breaker used with the coil (which made about 100 breaks per second), but this did not prove to be the case. In fact, very great changes in the rate of the circuit-breaker did not affect the note given by the tube. The effect seemed to be

[1] Read at a meeting of the American Academy of Arts and Sciences, November 10, 1880.

produced by the vibration of the sheet-platinum in its own period, under the influence of the molecular impact, which vibration was communicated to the glass walls of the tube by the enamel rod to which the platinum was attached, giving rise to a sound somewhat resembling the pattering of rain against a window-pane, but higher in pitch and more musical. This sound changed its character very greatly when the direction of the current was reversed, a feeble murmur only being heard. I obtained a similar musical note, though far less loud, with the "mean free-path tube," best when the middle plate was positive. With a tube containing phosphorescent sulphide of calcium, the note was very dull in its quality and low in pitch, but still quite perceptible. With this tube, a change in the direction of the current, as might be expected, did not affect the sound produced. I did not obtain this musical note from any tube that I have in which the current enters and leaves by a straight wire, except in the case of a single Geissler's tube exhausted so as to give stratifications, in which it was very feebly heard.

MICROTIA.

By DAVID HUNT, M.D.,

BOSTON.

By the courtesy of Dr. Clarence J. Blake, I have been afforded the opportunity of inspecting photographs of three cases of malformation of the auricle.

Case I.—J. C. W., aged twenty-eight. The auricle is represented by an irregular fold of skin; the parts corresponding to the helix, scaphoid fossa, and antihelix are folded forward; no trace of these divisions of the auricle are seen; about midway between the superior and inferior extremity of the malformed auricle a pronounced indentation extends into its base.

Case II.—Child of J. M. C. There is a general likeness to Case I., but the indentation there mentioned is so deep that it seems as if the malformed organ were reversed and the anterior surface of the auricle presented backward; in other words, the indentation is so deep as to resemble the fossa conchæ.

Case III.—Infant child of F. G. The auricle is divided into a superior and an inferior portion by a fissure which occupies about the same relative position as the indentation of Cases I. and II. The lower portion looks like a hypertrophied lobulus; the upper portion consists of two nearly concentric folds, united at their posterior extremities; the upper border of the superior fold shades off into the common integument.

The meatus is absent in every case; so far as can be observed there is no other malformation.

In the present condition of our knowledge of the subject the most practical and most interesting study of such cases is connected with their relation to the question of the development of the auricle and meatus.

In a communication which appeared in this journal (October, 1879) I mentioned the contradictions and apparent errors of those ideas of the pathological anatomy of congenital malformations of the external ear, which are based upon the supposition that the meatus

is merely a section of the first branchial cleft (Virchow, Schwartze); the apparent insufficiency of Moldenhauer's account of the formation of the meatus in explaining the facts which congenital malformations present was also noticed. Since that date Dr. Urbantschitsch's "Lehrbuch der Ohrenheilkunde" (Wien und Leipzig, 1880) has appeared.[1]

As this publication is the only otological text-book of recent date, in which a serious attempt has been made to state even the outlines of development, we shall use the cases now reported as tests of the opinions upon the subject of the development of the external ear which have been advanced by Urbantschitsch.

Concerning the auricle our author says: "The auricle occurs originally as a small tumid elevation on the posterior portion of the outer opening of the ear (Schenck). The different parts of the auricle may be made out on an embryo 1 ctm. long before the formation of the foot as such can be plainly perceived" (Löwe).

This statement—that the auricle forms very early—is quite common; a description much like the above can be found in almost any of the text-books on development. It is hardly necessary to say that it leaves the subject of malformations of the auricle in great obscurity; it is not true of the auricle of the pig; here the formation of the auricle is indicated by changes in structure of the branchial arches before the first cleft closes, although the auricle is not formed until a relatively late period of development; but as most of these statements are applied to the auricle of the human embryo, I have attempted to study the process upon them. It has been difficult to obtain a series of human embryos well preserved for this purpose; many place the young embryos in strong alcohol; many embryos are partially destroyed by mechanical means used in procuring abortion, many are ruined by long maceration. I have used only such specimens as were placed, when quite fresh, in Müller's fluid; after several weeks' hardening in this fluid they have been carefully washed out in alcohol and water and hardened in absolute alcohol; these facts may apologize for the imperfection of the series which I have illustrated.

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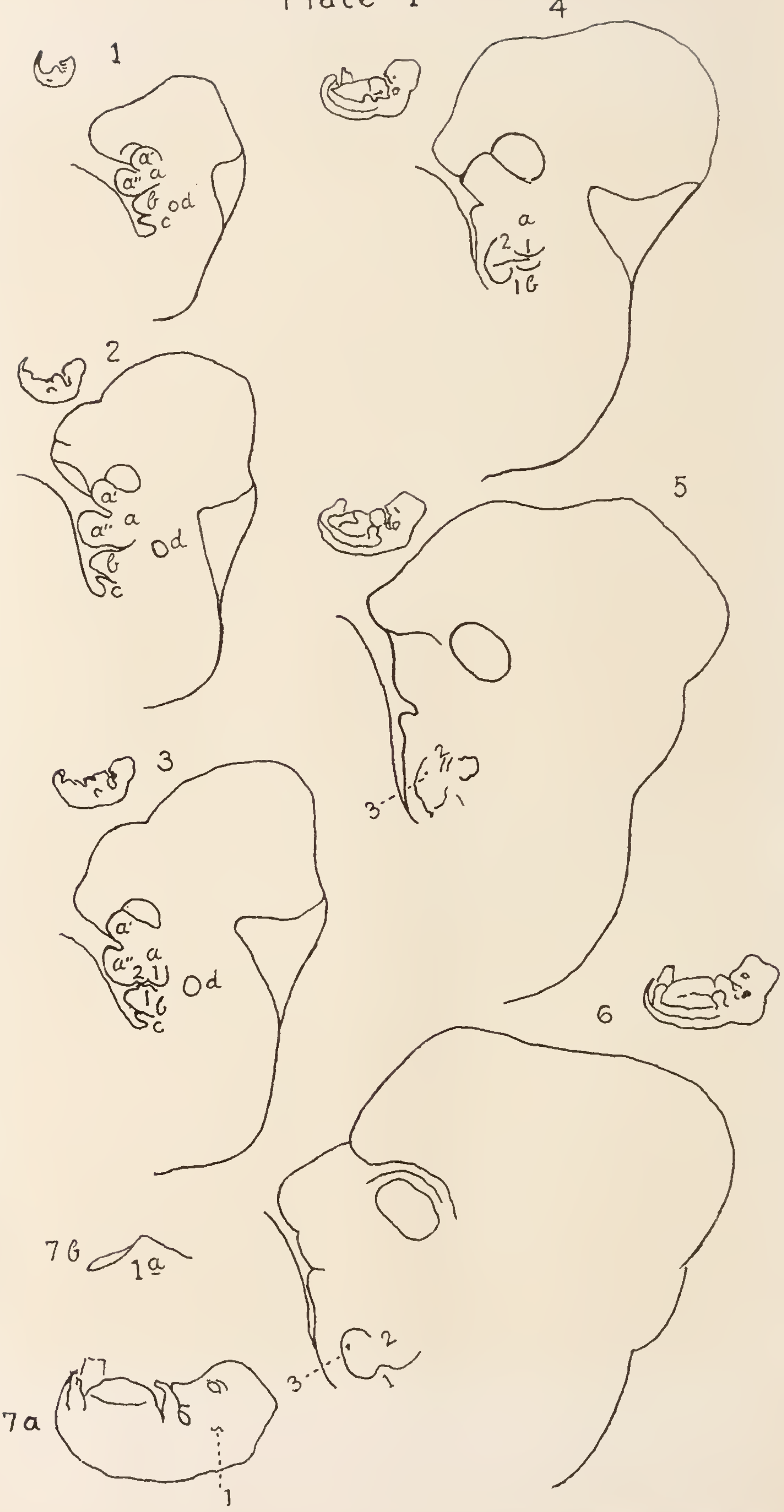
[1] Reviewed in this journal, October, 1880.

Plate 1



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The youngest human embryo is represented, actual size, in Fig. 1, Plate II.; its auricle is represented, Fig. 1′, magnified eight times; it is a nearly simple fold of skin on the posterior portion of the outer ear opening; on the anterior portion of the same opening the skin is raised in a faintly marked ridge; in the inferior portion of the cavity inclosed by the ridge and the auricle the little opening of the meatus is visible. This embryo is more than two centimetres long, yet "the different parts of the auricle" are not to be distinguished. So far is this from being the fact, that at the next stage (Fig. 2, Plate II.) we find the first pronounced trace of differentiation (embryo at about the tenth week). A representation of the auricle magnified eight times is seen in Fig. 2′; here we discover what seems to be the anti-tragus, but if we examine the next stage we shall find that it is yet undeveloped, so that the structure in question is probably the cauda helicis; the curve that bounds the lower portion of the anterior margin of the cauda is prolonged on the opposite or anterior margin of the conchæ in a furrow; some distance above is a nearly parallel furrow that marks the lower border of the spina helicis; the space between the two furrows is the beginning of the tragus; the spine of the helix and the tragus fill the concha; thus it is seen that a fold of skin, representing a portion of the auricle, forms on the posterior border of the external opening of the ear while the spina helicis and the tragus develop from the little ridge located on the anterior border of the same opening; fusion of the spine and the helix proper occurs at a later period of development; a defect in this process of fusion is, I believe, the cause of the notch or projection which Darwin has supposed may be a "vestige of formerly pointed ears."[1]

Fig. 3 shows a little later stage of development; the auricle magnified eight times is represented in Fig. 3′; the upper portion of the auricle was folded forward as represented; whether this fold is accidental or common to this stage of development I leave to be determined; the tragus is plainly defined, its growth seems to have caused the first trace of the scaphoid fossa which cannot be traced higher than about the middle of the auricle;

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[1] Descent of Man, p. 22. New York: Appleton, 1871.

the lobulus shows no trace of separation from the neighboring skin.

Fig. 4′ shows the auricle at about the third month; it differs from Fig. 3′ in the following respects; the tragus is more sharply defined, there are traces of the separation of the lobulus; the spine of the helix is more developed; traces of the crura furcata and the fossa intercruralis may be distinguished. This brief sketch of appearances observed in this imperfect series of human embryos is at least sufficient for demonstrating the error of those who state that all the different parts are perceptible in the auricle of the human embryo 1 ctm. long; it is time for us to dismiss all such superficial statements from our account of the development of the auricle, if we wish to realize any of the practical aids which embryology may furnish in anatomy.

Before we attempt to apply the facts which we have noticed in our sketch of some stages of development of the human auricle, let us examine briefly the order of phenomena in the development of the auricle of the pig.

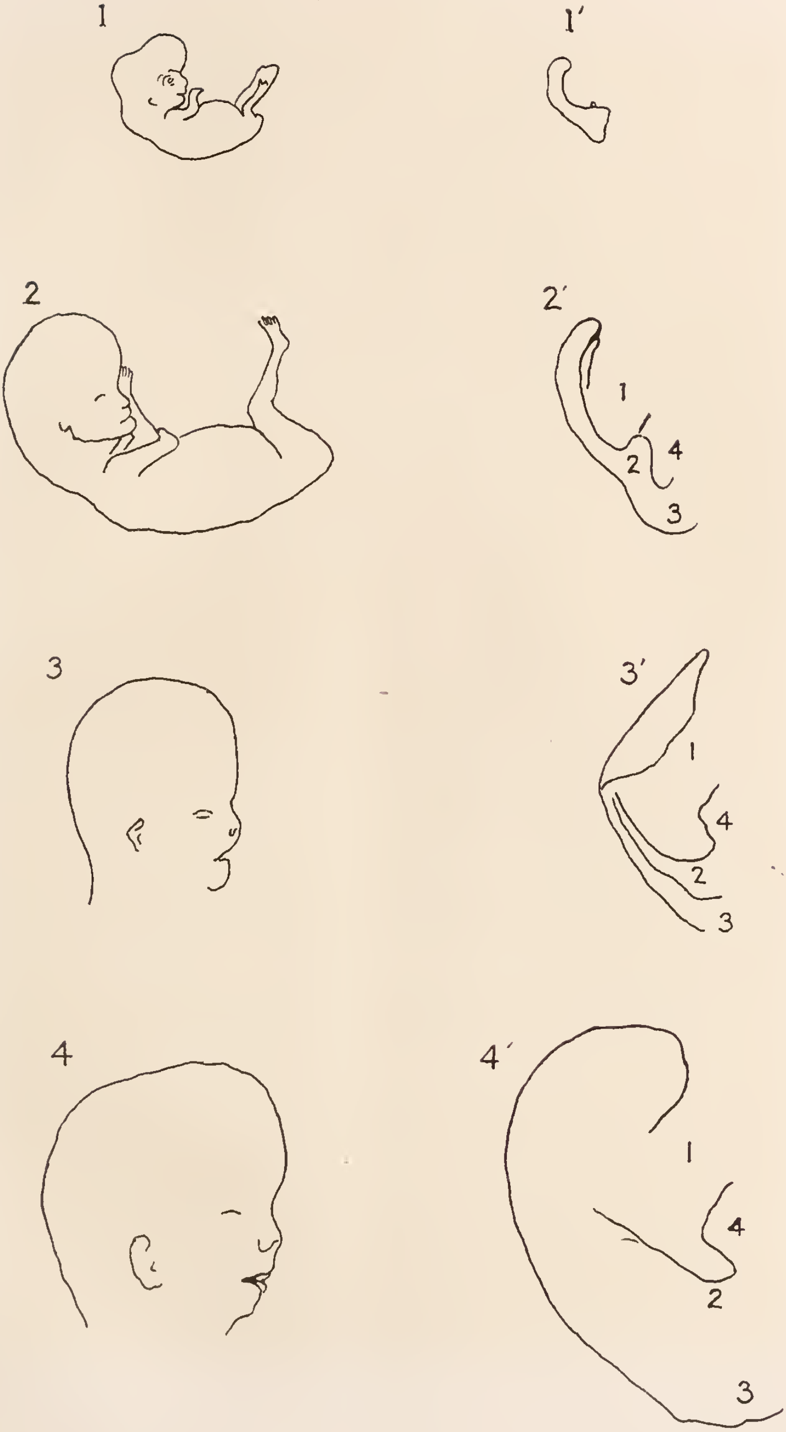
Fig. 1, Plate I., represents the cephalic extremity of an embryo pig, one-fourth of an inch long; the small figure adjoining this, and those accompanying the subsequent figures of this plate are intended to represent the actual size of the embryos described; they are pretty correct as to the long axis. In Fig. 1, we can make out the first branchial arch, *a*, its superior maxillary process, *a′*, its inferior maxillary process, *a″*, the second arch, *b*, and the third arch, *c;* the otic vesicle, *d*, is seen nearly on a level with the root of the second arch.

Fig. 2 shows but slight change; the posterior and inferior portion of the first arch is more angular, the root of the arch forms a little plateau.

Fig. 3, there is a double indentation of the lower border of the first arch, 1, 2, and a slight protuberance upon the second arch, which causes a little irregularity in the contour of its upper border.

Fig. 4, the first branchial cleft has just closed; occupying the site of the adjoining borders of the first and second arches, is a shallow depression; its deepest portion forms a narrow groove, which at first sight makes it appear as if the arches were not com-

Plate 2



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pletely closed. Careful examination shows that the integument lines this groove, and the outline of the profile of the cervical portion of the embryo is not broken by any indication of the former existence of the branchial cleft, the shallow depression does not communicate with the pharynx. At this stage it is easy to trace the history of the little protuberances noticed upon the branchial arches in describing Fig. 3; that marked 1, on the first arch, has become the little elevation that narrows the posterior portion of the depression in Fig. 4′; that marked 2, in Fig. 3, is now recognized as a ridge making into the depression; while the projection *b* 1, on the second arch, Fig. 3, is here a well-defined elevation that also loses itself in the depression; the meatus is not to be discovered.

Fig. 5. It is seen that the protuberance noticed on the second arch, in describing Fig. 3, has become the point or apex of an elevation, which it is not difficult to recognize as the auricle; the protuberance marked 1 on the first arch in Fig. 3, is a part of this ridge, while that marked 2 still projects into the depression. In this figure we find the first trace of the meatus, 3.

Fig. 6 shows all the appearances just described, but more clearly marked, while Fig. 7*b* represents a pig-embryo, natural size, with a well-defined auricle; Fig. 7*a* represents the auricle magnified eight times; it is seen bent forward over the depression on the posterior border of which it has formed.

Thus the development of the auricle is seen to proceed from the growth of little protuberances situated upon the first and second arches; this growth takes place around a shallow depression which is formed after the arches are united; the meatus is formed at a later stage by an involution that occurs in the depression. Can there be any doubt, then, that the depression thus defined is the concha? Yet Moldenhauer and Urbantschitsch call it the membrana tympani, and they describe the structures which we have shown form parts of the auricle in the pig as rudimentary portions of the meatus externus. This seems to me the nodal point of the errors which have prevented these writers from realizing practical value in applying their doctrines of development to the explanation of the occurrence of congenital malformations. Confin-

ing our attention to Urbantschitsch let us examine his opinions as they are given in his text-book. At the beginning of the second chapter he says: "The external meatus, as recent investigators demonstrate (Hunt, Moldenhauer, and myself), is not developed from the first branchial cleft; in accordance with the view of older authors (Autenreith, v. Baer) it occurs from that mass of formative tissue surrounding, like a wall, the drum-membrane which is situated in the same plane as the rest of the integument." As a result of this opinion as to the site of the drum-membrane, Moldenhauer and Urbantschitsch are debating the questions whether it obtains its deep situation by continually sinking into the side of the face, or whether the side of the face pushes outward as it grows thicker so as to form the meatus. I cannot understand how either opinion accounts for the relations of the drum-membrane; the hammer handle can be demonstrated in the connective tissue of the membrana tympani from the first; the drum-membrane forms the outer wall of the middle ear cavity from the first, and this cavity lies next to and partially under the cochlea at the period of its appearance; how can we reconcile such facts with the statement that the drum-membrane appears and continues for a long time on the surface? But exact observation of the development of the auricle proves that this depression is in reality the concha; further observation will, I am sure, confirm this observation and show that the portion of the pharyngeal involution extending beyond the site of the middle-ear cavity lines the mastoid cell, as the portion of the involution of the integument extending beyond the margin of the drum-membrane forms the sinus of the meatus. In accordance also with this error as to the mode of origin of the drum-membrane and the meatus externus, we find Urbantschitsch (p. 103) making the statement that "important malformations of the external meatus extend often to the middle-ear cavity, and almost always to the auricle. The occurrence of a normal auricle, together with a malformation of the meatus (case of Obertueffer), is of the greatest rarity." What evidence is there, according to Urbantschitsch's own account, that the fault originates in the meatus? I find it difficult to conceive how this can be the case; according to his statement the auricle forms around the site of the drum-membrane, and the latter,

in some mysterious manner, sinks down to form the meatus. Why should an arrest or fault in this process of sinking of the drum cause a malformation of the auricle?

Why may not the malformation originate in the auricle, exposed as it is in a greater degree to mechanical injury and being formed, according to his description, before the meatus? However this question may be answered in the light of Urbantschitsch's opinions, there is no doubt but that, according to our own views, it is much more probable that the origin of the morbid process is in the auricle; instead of recurring to a disturbance in the process of closure of the first cleft (Schwartze), or instead of citing an equally incomprehensible interference, with a process of sinking of the drum-membrane, we look upon the association of the malformation of auricle and meatus as due to the interruption of a natural order of events, according to which a certain stage of development of the auricle precedes the formation of the meatus. The auricle is a very variable organ; we have referred to the notch which has been noticed by Darwin; how frequently do we see the lobulus attached to the neighboring skin as in embryonic life, or remark variations or absence of the ante-helix (in the case of a young gentleman who consulted me on account of an optical defect within the past fortnight, it was absent in one auricle and well defined in the other); how often do we meet with variations of the crura furcata and of the fossa intercruralis; these variations form one extreme of a series of malformations; the other extreme of the same series is formed by those cases in which the disturbance is so profound as to interfere with the development of the fossa conchæ to an extent sufficient to interfere with the involution of the meatus. In regard to the development of the drum-membrane Urbantschitsch writes as follows (p. 151):

"According to the teachings of Reichert, which have been, up to this time, generally received as correct, the drum-membrane was supposed to form from the tissue which growing into the first branchial cleft divided it into an outer and an inner section, that is, into the outer and middle ear. However, as we have previously remarked, the drum-membrane originates from the outer integument; it is originally situated in the same plane with it. The por-

tion of the outer blastodermic membrane, belonging to the drum-membrane, is separated from the rest of the cutis by the tissue which forms the meatus externus, while, by the development of the middle ear, a cavity is formed to the inside of the membrana tympani. Then, only, does it acquire the character of a partition which, as is seen from the preceding description, it does not originally possess."

It can be easily demonstrated that the middle-ear cavity exists at a very early period of development if we regard it, as it really is, as merely a section of the pharyngeal involution which forms the Eustachian tube; if we restrict the term to the enlargement of the pharyngeal involution which occurs as a result of the absorption of connective tissue around it which accompanies the formation of the auditory ossicles it is evident that we assign to the middle ear a much later origin, but at this period the middle-ear cavity does not approach the surface; the drum does not form a boundary for its outer but for its inferior aspect; in other words, it separates the middle-ear cavity above from the meatus externus beneath; the manubrium of the malleus, itself an extremity of Meckel's cartilage, develops in its connective tissue while it occupies this position, and it forms an early connection with the incus which develops in neighboring connective tissue, as the latter does with the stapes which separates from the cartilaginous ear capsule. It would be easy to speculate as to the causes of the different shapes which malformed auricles assume, but we can make no definite statements upon this point. I think that we may assume that the embryonic auricle is composed of three principal parts:

First.—The little ridge on the posterior margin of the ear opening; in the pig this grows from the tissue of the second branchial arch and forms the chief portion of the pointed auricle of this animal; it also forms a large part of the auricle of man.

Second.—The spine of the helix; in pigs this probably forms from the inferior angle of the dorsal end of the first branchial arch; in the human embryo it fuses with the fold that forms on the posterior margin of the ear-opening, and forms a considerable portion of the upper part of the human auricle.

Third.—The tragus; in pigs this is probably indicated by the

second prominence on the first branchial arch; in the human embryo, so far as we know, it develops in the fold of integument bordering the anterior margin of the outer ear-opening.

The remaining divisions of the human auricle develop secondarily from the ridge described as originating on the posterior border of the outer ear-opening. Here we have observed the differentiation of what we suppose to be the cauda of the cartilaginous helix, this being the first step; the second, as we have seen it, results from the growth of a plainly defined tragus, and consists in the commencement of the development of the scaphoid fossa.

The only modification of current views concerning the congenital malformations of the external ear-passages which Urbantschitsch has made as a result of his investigations upon the development of the ear is, that congenital aural fistulæ are a result of defective closure of the first cleft. I had stated that such might be the case, in the communication already referred to as having appeared in this journal in October, 1879.

PERFORATIONS IN THE MEMBRANA FLACCIDA, THE TYMPANIC DISEASES THEY ACCOMPANY, AND THEIR TREATMENT.

By CHARLES HENRY BURNETT, M.D.,

PHILADELPHIA.

The membrana flaccida, or the flaccid membrane of Shrapnell, may be briefly described as a fan-shaped region, the lower borders of which, or the imagined sticks of the fan, run backward and forward from the short process of the malleus above the upper edge of each so-called fold of the membrana tympani, forming a lower boundary about 5 mm. long. The upper edge of this important part of the membrana tympani corresponds to that peculiar part of the general periphery of the drum-head known as the segment of Rivinus. The latter is, perhaps, more accurately described as the margo tympanicus, or the inner edge of the upper bony wall of the external auditory canal, and may be looked upon as the osseous complement of the annulus tympanicus, to the innermost and free edge of which the external ligament of the malleus is attached. The membrana flaccida thus outlined is about 3 mm. high, measuring from the short process up to the point of attachment of the membrane to the upper osseous wall of the auditory canal. This membrane is composed of only two layers, an outer skin layer from the auditory canal and an inner layer of mucous membrane reflected from the tympanic cavity and the inner surface of the margo tympanicus. Directly behind the central part of the membrana flaccida is the neck of the malleus, the head of which lies behind the margo tympanicus. The front part of this membrane is stretched over the anterior upper part of the tympanic cavity, entrance to which at this point is above the so-called anterior pocket of the drum-head. The back part of this membrane, behind the neck of the malleus, is stretched over the front end of a long and shallow

groove yet to be described, and at this point the membrana flaccida is about 2 mm. from the lower part of the body of the incus. This posterior, groove-like cavity is wedge-shaped, bounded on its inner side by the upper part of the body of the incus and its short horizontal process, and on its outer side by the inner surface of the margo tympanicus. The edge of the wedge-shaped groove points downward, and its base opens upward toward the tegmen, while in its long diameter it widens and fades away backward into the tympanic cavity and mastoid antrum. At its anterior end and on its outer side this groove is covered in from the external auditory canal by the back part of the membrana flaccida. Hence, when the membrane gives way at this point, egress is given to matter from the upper and back part of the tympanic cavity, and from the mastoid antrum.

Sometimes a perforation in the membrana flaccida is directly over the short process of the malleus, opening then into what is termed by Prussak and Gustav Brunner, a third pouch of the drumhead. This third pouch is said by the former writer who first described it, to open into the tympanic cavity at one point only, viz.: backward over the position of the posterior pouch of Von Troeltsch.

In perforations of the central part of the membrana flaccida, the neck of the malleus is exposed, and in anterior perforations, *i.e.*, in those in front of the neck of the malleus, entrance is effected directly to the large, upper space in the front part of the tympanic cavity, near the tympanic end of the Eustachian tube.

Posterior perforations are usually attended with great discharge, and connected with mastoid symptoms; they are also the most obstinate and accompanied by profound deafness.

Central perforations are most apt to be connected with disease in the external auditory canal, but are least obstinate to treatment, and are not usually attended with such profound hardness of hearing nor so great a discharge.

Anterior perforations are most likely to be connected with pronounced disease in the nares, Eustachian tube, and the tympanic cavity, and to give exit to a copious discharge. But they have seemed to me to be the most remediable and are followed by the greatest return to good hearing.

In cases of destruction of the entire membrana flaccida, attended with erosion of the margo-tympanicus, there come into view, directly over the line of the folds of the membrana tympani proper, the neck and head of the malleus, and the junction of the latter with the incus, the body of the incus with the upper part of its descending crus, and the proximal part of its short, horizontal crus. In such cases of extensive destruction the entire dome of the tympanum under the roof can be viewed by turning the patient's head to the opposite side, and there may be seen as well the cavity of the upper and front part of the tympanum, and a dark cavity, in the back part of the space thus opened around the head of the malleus and body of the incus, which is the beginning of the mastoid antrum.

When the perforation is in the anterior part of the membrana flaccida, the Valsalvan inflation is likely to produce a characteristic perforation-whistle, but when the perforation is elsewhere in the flaccid membrane, a perforation-whistle on inflation by any means is not likely to be produced, as can be readily understood upon reflecting, that, except in anterior perforations, the body of the malleus and incus intervene between the cavity of the tympanum and the perforations. Another feature in these cases of perforation in the membrana flaccida, is the absence of perforation in the membrana tympani below the folds. I have never observed a perforation here coexistent with perforation in the membrana flaccida: but Dr. C. J. Blake[1] has given an account of a case in which a small perforation in the flaccid membrane was associated with a large opening in the membrana tympani proper, and so far as I know his case is unique. Sometimes, especially in the posterior forms, denuded bone can be felt through these perforations. My experience in this form of aural disease extends over ten cases, four of which are given already elsewhere,[2] and the notes of six others I propose to lay before the reader in this paper. Perhaps one of the rarest features in these cases is to find a similar perforation, or, in fact, a perforation of any form, in both membranæ

[1] Transactions American Otological Society, Vol. I., p. 546, 1875.

[2] Treatise on the Ear, p. 336. Philadelphia, 1877, where Case I. is continued in this paper as Case II.

flaccidæ existing at the same time. An account of such a rare occurrence will be given in Case III.

Treatment.—The existence of a perforation in the membrana flaccida, excepting, perhaps, the central variety, indicates great disease in the upper part of the tympanic cavity. As the bulk of the malleus and incus lies in the dome of the tympanum, directly behind the membrana flaccida, there is necessarily an impediment offered by them to the escape of matter from the cavity of the drum, when the perforation in the membrana tympani is in the flaccid part.

The treatment of tympanic disease, in these cases in which the perforation in the flaccid membrane is but a symptom of the position of the disease, the only treatment of worth, is by means of the tympanic syringe. The form I have used for some years is that described by Dr. C. J. Blake, in No. 1, Vol. II., of this journal. A full description, with a woodcut, is there given of this invaluable instrument, as used by Dr. Blake for several years previous to his published account of it. It consists briefly in a dentist's syringe of hard rubber, about 9 ctm. long, and about 1.50 ctm. in diameter. To this is added a short tube of glass, making a transparent "neck," in diameter 5 mm., to which curved nozzles 9 ctm. in length, with diameters varying from ½ to 1½ mm. may be fitted. The neck above alluded to may be of glass or metal, and should be made to screw off and on. A metal "neck" has proved most satisfactory to the writer, because much more durable than glass; but the latter should be used if the syringe is to be employed as an aspirator, as it is sometimes, with advantage. With such an instrument the surgeon can both cleanse and medicate directly a diseased tympanum far better than in any other way. The experiences of J. Orne Green,[1] C. J. Blake,[2] A. H. Buck,[3] and H. G. Miller,[4] are of great interest and value in further elucidation of this important form of aural disease.

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[1] Boston Med. and Surgical Journal, March 26, 1874.

[2] Transactions American Otological Society, 1874, Vol. I., p. 546.

[3] Diagnosis and Treatment of Ear Diseases. New York: Wm. Wood & Co. 1880.

[4] Transactions American Otological Society, 1878, Vol. II., p. 257.

Case I.—*Perforation in the anterior part of the membrana flaccida, right ear; Polypus attached to perforation and occupying entire membrana flaccida.*—On August 14, 1878, Frank C., aged twenty-seven, a merchant, presented himself for treatment for a disagreeable aural discharge and deafness in the right ear. His statement was that three years previous he had suffered, for the first time, from earache and a running from this ear, since which time more or less discharge from the right ear had continued.

An examination of the case revealed almost total deafness on the right side, the voice being heard only when close to the ear; the other ear was normal. The tuning-fork on the vertex was heard best in the diseased ear. There was no pharyngeal disease. Inspection of the membrana tympani revealed a normal drum-membrane, bathed slightly by pus, which seemed to flow over it from a bright polypus seated over the entire membrana flaccida. The folds of the membrana tympani were well marked, and above them the polypus lay in its aforesaid position. The polypus was extracted by means of a Blake's snare, with a narrow canula, as modified by myself, for conveying the wire, and the attachment, which seemed broad, was touched with a saturated solution of nitrate of silver (480 gr.—f. ℥ j.), conveyed to it by means of a small roll of cotton on a cotton-holder. The attachment was treated the same way on the third day after, and when seen two days later the pedicle was no longer visible, thus leaving a free surface over the entire membrana flaccida, which appeared more hollowed than usual, and the folds of the membrana tympani were thus thrown into greater prominence.

More or less discharge, however, continued to come into the auditory canal from a perforation in the anterior part of the membrana flaccida, which perforation had been discovered after the removal of the polypus, which seemed to spring from its neighborhood. This discharge seemed to be diminished by the use of alum in and about the perforation, and finally, in less than a month and after a few applications, it ceased entirely for nearly a fortnight.

On the 24th of September, a little over a month from the time the patient was first seen, a slight hemorrhage occurred from a small vessel running in the membrana flaccida, and a slight discharge set in from the tympanic cavity through the opening in the membrana flaccida. This was controlled by the use of powdered alum, and the ear became dry, no granulations were visible, and the swelling about the perforation went down. The neck of the malleus could now be seen, and pressed upon and moved by a probe through the perforation in the membrana flaccida, showing that the opening had extended from the front to the central part of the flaccid membrane. The probe could be passed 4 mm. point-blank into a cavity, beyond the perforation. The discharge, however, returned again in slight quantity, and a new treatment was used in the form of the tympanic syringe. By this means in less than a

month the case was permanently cured of the discharge, and the hearing was restored, as the rest of the notes will show.

The first injections were made on October 1st. A nozzle, which is slightly curved, was used and turned toward the tegmen tympani. By this means a mixture of warm water and alcohol was first used, whereupon a little earache ensued, for a few minutes. The next day a little tenderness was complained of, and the pus seemed a little more copious, but creamy and laudable. The tympanic cavity was then cleansed with warm water by means of the tympanic syringe, and afterward a few drops of a solution of nitrate of silver (5 gr.—f. ℥ j.) was injected by the same means. On the next day the discharge seemed greater, and patient complained of a feeling of soreness deep in his ear, and I desisted from the use of the tympanic syringe; but the true cause of the increased discharge and pain seemed to be a cold which was fully developed in the patient, by the next day. The discharge seemed now to diminish, but it persisted, and in the course of two days the cleansing and medication by means of the tympanic syringe were resumed, and after washing out some cheesy pieces through the perforation, I injected a few drops of a stronger solution of nitrate of silver (60 gr.—f. ℥ j.). No discomfort of any kind ensued, but the patient expressed himself as feeling "comfortable in the ear," and in the course of three days, when he called again, a throbbing, which he had often felt in his ear, he stated, had ceased. At this visit the tympanic syringe was used only for cleansing the cavity, and a little cheesy matter was washed out.

On the next day, October 9th, a mere trace of creamy pus was seen around the perforation, the membrana tympani below the folds was dry and lustrous, the entire ear felt comfortable to the patient, and the hearing began to improve. At this time the cavity was cleansed with the tympanic syringe and a very little inspissated matter was washed out, after which, by the same syringe, a few drops of a stronger solution of nitrate of silver (80 gr.—f. ℥ j.) was similarly injected. No pain or discomfort of any kind ensued. In the course of two days when the patient was next seen, a little discharge was found coming from the perforation, though the patient was not conscious of any moisture in his ear. Nothing had been done to the ear by the patient in the interim of the visits at any time, as all the local treatment was done entirely by the writer. The discharge seemed at this visit a little stained with the silver solution, but its entire amount was not more than a small drop. The cavity was syringed out by the tympanic syringe, and a few whitish flakes were thus removed; after which a few drops of a still stronger solution of nitrate of silver (100 grs.—f. ℥ j.), were injected into the cavity with the tympanic syringe. No pain nor discomfort ensued, and the space beyond the perforation was dried out by means of absorbent cotton on the cotton-holder, after the auditory canal had been syringed, so as to leave no solution of silver there. On the next day there was *no discharge* visible, the perforation was *dry*, and the cotton on the cotton-

holder, passed into the cavity through the perforation, brought out a little brownish matter. The cavity was then syringed with warm water by means of the tympanic syringe, but no flakes were thus removed, and no application of silver was made.

In two days, during which nothing had been done to the ear, it was found to contain no discharge, and the membrana tympani was dry in all parts. The cavity was simply dried out by absorbent cotton, but no medication was applied to the ear. The next day the ear was found to be still entirely free from discharge, and the patient could hear with this ear a whisper, ten feet. A few brownish silver-stained flakes were at this visit washed from the cavity by means of the tympanic syringe. The patient was not seen again for a week, when it was found that the ear was entirely free from discharge, and again in a week later when he was seen, the ear was found to be entirely free from discharge, and the perforation was closed by a thin brownish pellicle, varnished in appearance, and probably a fresh growth of delicate cutis from the upper wall of the external auditory canal.

It seems fair to conclude that this case was speedily cured by the use of the tympanic syringe.

Case II.—*Perforation in the posterior part of the right membrana flaccida; denuded bone felt through the perforation; mastoid symptoms.*—The early history of this case is given as Case I. among the cases alluded to in my treatise. As a relapse occurred, and the cure was accomplished thereafter by different means from those employed in the first instance, the later notes of the case seem worthy of being put in here.

John M. was first treated by me between 1872 and 1875, from his seventeenth to his nineteenth year, for a chronic purulent discharge from a posterior perforation in the right membrana flaccida. The disease dated back to early childhood, and was supposed to be due to severe colds which he had contracted in Canada. After checking the discharge with intervals of return, the case passed from my notice until 1879, when, in his twenty-fourth year, he presented himself for treatment.

On the 2d of February, 1879, I found the external auditory canal tumid at the inner and upper end, where it joins the membrana tympani, and the latter in its posterior half seemed to bulge far forward toward the anterior wall of the canal. It was pinkish, greatly macerated with pus, looked like ordinary skin, and the malleus was not visible. When the drum-head was pressed upon below, pus welled out from the perforation in the flaccid membrane. The condition of the ear at that time had been brought about apparently by unavoidable exposure to a storm of wind and sleet a short time previous. After the exposure, dull earache was soon felt, then a discharge set in for the first time

for nearly four years, and the patient once more sought treatment. The mastoid process was not markedly involved at this time, though it had been some years previous the seat of great pain and tenderness. Denuded bone now could be felt by passing a probe directly through the perforation, and was in all probability a bare spot on the margo tympanicus, or on the incus. The hearing was greatly reduced, the pain had been very slight within the twenty-four hours just passed, the general health was good, but the right pupil was more dilated than the left. The ear was kept carefully cleansed by warm water syringing for a week, during which the patient was not seen, as he resided in another city where he was in college.

In the course of ten days, when the patient was seen again, the drum-head had assumed a more normal position and appearance and the malleus was visible. The tympanic cavity was at this time cleansed by the tympanic syringe already described.

After the cleansing a few drops of a solution of nitrate of silver (80 gr.—f. ℥ j.) were injected with the tympanic syringe, through the perforation into the cavity beyond. At home he was to keep the ear clean by syringing with castile soap and warm water. In four days the membrana tympani was seen to have assumed still further a more normal appearance and the discharge from the perforation was less. The same treatment with the tympanic syringe was gone through with and the patient was not seen for a week. When he came again there was scarcely any discharge, and the membrana tympani looked nearly normal below the folds. At this visit a solution of only 60 grains of nitrate of silver to the fluid ounce of water was applied to the tympanic cavity. By the use of the tympanic syringe some cheesy matter was washed out through the perforation in the flaccid membrane, and the patient told to let his ear alone and not to syringe it; but he did not carry out these orders, and when he came again a small polypus was seen to have sprung up over the perforation, very probably as the result of too much syringing. The polypus, which was quite vascular, was pulled away with Blake's snare, and a few drops of a solution of nitrate of silver (480 gr.—f. ℥ j.) injected into the cavity through the perforation, without any discomfort or inflammatory reaction. In a week, when the patient was seen again, there was no discharge from the ear. In the course of a fortnight the patient caught cold, and there was a slight return of discharge from the ear, accompanied by tumidity and soreness in the region of the perforation and the posterior wall of the inner end of the auditory canal. All these symptoms, however, soon vanished under gentle syringing and the injection of an acid solution of acetate of lead and laudanum, by means of the tympanic syringe.

The denuded surface of bone felt through the perforation, now seemed much less in extent, and gradually it appeared to be covered over with periosteum, as it no longer could be detected with a probe. The hearing became

relatively normal, the patient being able to hear the voice three or four feet, and a pocket watch $\frac{6 \text{ in.}}{60 \text{ in.}}$ This improved condition continued for some months, after which, the patient being obliged by various duties to stay in another city, no further notes of the case can be given, though there is reason to believe his condition has remained good.

At no time in this case was there ever any perforation-whistle upon inflation of the tympanum; there was evidently purulent matter in the cavity of the tympanum, as shown by the welling out of pus through the perforation in the flaccid membrane, when the membrana tympani below the folds was pressed upon.

The hardness of hearing was at times profound, and the symptoms of disease in the back part of the upper tympanum and mastoid region were marked. The unequal dilatation of the pupils is well worthy of note, for it is said by the patient that this had been the case always since his ear had been affected, *i.e.*, since he was twelve years old; it consisted in a partial paresis of the right iris, which, though dilatable, was sluggish under the same stimulus, in comparison with the left, and it would never open as widely as its fellow.

In the treatment it is worthy of note that the tympanic syringe was the only means of cleansing and medicating the diseased cavity, and also that the very strong solutions of nitrate of silver were efficient in their action and caused no pain.

Case III.—*Anterior perforation in each membrana flaccida; naso-pharyngeal catarrh; purulent discharge from each tympanic cavity.*—Theodore M., aged ten years, is said to have had discharge from his right ear when two years old, the only cause of which is said to have been cold in the head. Some years later the left ear began to discharge from apparently the same cause, and both have run greatly ever since. Four years ago he had measles, since which the ears have been worse.

The case came under my observation through the courtesy of Dr. H. N. Spencer, of St. Louis, Mo. Upon inspection I found each external auditory canal half filled with offensive purulent matter, and a perforation, anterior to the neck of the malleus in each membrana flaccida; the rest of each membrana tympani was intact. The nares were chronically inflamed, and the naso-pharynx clogged with a scanty, tenacious, yellowish mucus, all of which induced the child to breathe through his mouth. The alæ of the nose were hence weak, ill-developed, and the nose looked pinched and too small for his face. There was not, nor has there ever been, any bleeding from the nose, nor can blood be ob

tained on cotton, on a probe passed behind the velum into the naso-pharynx, there, as would be were granulations there. His lips were usually parted and dry, and the fauces looked as those do which are exposed to respiration through the mouth.

The hearing on the left side was for the voice two and one-half feet, and on the right side, four feet. Both ears were easily inflated either by Politzer's method or by Valsalva's, the perforation-whistle being very loud, and pus was seen to issue from the perforations during this latter inflation. The general appearance of patient was strumous.

Treatment.—The patient was now to have applied at home, to each nostril every morning on getting up, five drops warmed of the following prescription:

℞. Zinci sulph..	gr. j.
Sodii chlorid..................	gr. iv.
Aquæ...	f. ℥ j.

This was applied with a medicine-dropper and allowed to trickle back through the inferior nasal meatus to the fauces. At night, in a similar way, an equal quantity of a solution of nitrate of silver (½ gr.—f. ℥ j. water) was applied to the nares. There was no domestic treatment laid out for the ears. Each day I syringed them first with an ordinary syringe, and then cleared each tympanic cavity, through the perforation, by means of the tympanic syringe. After thus cleansing the ears, there was syringed into each tympanic cavity a small quantity of absolute (anhydrous) alcohol. The naso-pharynx was touched each day, by passing a tuft of cotton on an aluminium probe, soaked with the following mixture:

℞. Potassii iodidi................................	0.50 ctgr.
Tr. iodinii.......................................	5 ctgr.
Aq. destill.......................................	10 ctgr.

This treatment was carefully carried out every week-day for a month, during which the nasal respiration improved, and there was much less hawking, especially in the mornings, on getting up.

The aural symptoms did not improve under the alcohol treatment, the matter discharged was markedly purulent, and it might be said that the ears were exactly as they were before the month's local treatment. Sometimes the left ear seemed to discharge less, but I learned that this had always shown periods of less discharge, no matter what was being done for the ears.

Therefore, on November 8, 1880, after one month of observation of the case and the above treatment of the ears, the treatment was changed from the alcohol-applications to the use of strong solutions of nitrate of silver. On that date, the tympana were cleansed as formerly with the tympanic syringe, and then a few drops of a solution of nitrate of silver, sixty grains to the fluid

ounce of water, were injected through the perforations into each tympanum by the tympanic syringe. This caused no sensation of any kind to the patient, and on the next day, after cleansing as usual, a few drops of an eighty-grain solution of nitrate of silver was injected into the tympanum with the tympanic syringe. On the following day, *i.e.*, after two applications of nitrate of silver as above stated, the discharge seemed slightly less, and the tympana were cleansed simply, without receiving any treatment with a solution of nitrate of silver. The eighty-grain solution of silver was applied again on the 11th of November, but nothing except cleansing was done to the ears on the 12th, when the discharge seemed lessening. The fauces were still touched every other day with the iodine solution above described.

The alæ of the nose seemed stronger when felt during his movement of them, between my thumb and forefinger; his respiration is less by the mouth, and he hawks and spits less from his throat and blows less from his nose.

The case just narrated teaches very little, if anything, by its treatment, so far, except perhaps the stubbornness of such forms of disease. The Valsalvan inflation causes pus to flow from the perforations and gives a loud perforation-whistle, which is interesting, as usually perforations in the membrana flaccida are not attended with a perforation-whistle on inflation. A perforation, too, in each membrane is noteworthy, as well as the youth of the patient, these perforations not, as a rule, being observed in so young a subject. The case is given, therefore, on account of its history and description, rather than for the success of its treatment, which so far, November 15, 1880, has not controlled the disease to any marked degree.

CASE IV.—*Destruction of the entire left membrana flaccida; erosion of the margo tympanicus; exposure of the head and neck of the malleus and of the body and proximal part of each crus of the incus.*—Miss H., aged thirty-five years, came under observation November 3, 1880, and stated that she was affected by pain and discharge in the left ear, in early childhood. This past summer, in August, she bathed freely in the surf at Cape May, and exposed herself to the full entrance of water into both ears. She finally, after two or three weeks of such exposure to cold salt-water, observed tinnitus and hardness of hearing, with some pain, in the left ear. At this time some hardened secretion was washed from her ear, which relieved the tinnitus and hardness of hearing, the pain having already ceased. Dr. H. S. Schell, who attended to the case for me, ordered her at that time to use a warm-water aural douche, but she could not on account of the great dizziness caused by it. The membrana tympani were found to be red,

opaque, and flat, and the watch was not heard in this ear, but the tuning-fork, on the vertex, was heard best in this ear. Air entered the tympanum upon inflation, but no perforation-whistle was elicited.

In the course of a day or two the hearing rose to six inches for the watch and the destruction of the flaccid membrane was diagnosed, and from the cavity beyond, a cheesy mass was removed.

On November 3, 1880, when first observed by me, entire destruction of the flaccid membrane was seen, with extensive erosion of the margo tympanicus, which exposed to view most distinctly the head and neck of the malleus and the body of the incus, with the proximal parts of each crus. These ossicles, so far as could be seen, were covered with their natural mucous-periosteal covering, and were white and shining. Entirely around and above them there was a semicircular opening, 4 mm. in diameter, which permitted a view into the upper part of the tympanic cavity, under the tegmen. This cavity was partially packed with cheesy débris, after removal of which the mucous membrane lining the cavity could be seen by careful illumination. This membrane was not very red, but looked puckered and gave off a thick, offensive, dark and scanty matter, not sufficient, however, to bathe the membrana tympani below the folds. When first seen by me, there was also a slight hemorrhage, which continued for two days to trickle from the back part of the cavity over the back part of the drum-head and out at the meatus. This had been observed at the meatus by the patient for a day previous to her coming to me. Her hearing at this time in the affected ear was three to four feet for words spoken in a low tone.

Cleansing the tympanic cavity by means of the tympanic syringe could not be carried out, because of the great dizziness brought on by a trial of it. Recourse was then had to absorbent cotton on the cotton-holder, by which the cavity was very gently swabbed out. After the offensive matter had been removed in this way, the cavity was further swabbed out by absorbent cotton soaked in Condy's fluid (permanganate of potash) and warm water. After thus cleansing and disinfecting the cavity it was medicated by conveying to it, in the same manner, some of the following mixture:

℞.	Liq. plumbi subacetatis	♏ xx.
	Acidi acetici diluti..............................	♏ vi.
	Liq. opii sedativi..............................	♏ xx.
	Aquæ...............................q. s. ut ft.	f. ℥ j.
M.		

Under this latter method of daily cleansing and medicating by cotton on the cotton-holder, the discharge ceased in twenty days, and all signs of otitis externa diffusa which had existed, during the first part of the observation of

the case, disappeared. There had been pain at times, referred to the left eye and brow, and under the left ear; sometimes a pain had darted from the left ear backward toward the occiput. The perforation became much smaller and seemed likely to close entirely.

CASE V.—*Chronic purulent otitis media on both sides; entire destruction of the flaccid membrane on the right side.*—On December 4, 1877, the Rev. Mr. Y., forty years old, consulted me about a discharge from both his ears, which had existed since scarlatina in early childhood. He was of German origin, and had endured a life of hardship as a boy, when he had been beaten a good deal about his head. The hearing in his left ear was nearly gone, but the right ear, notwithstanding the destruction of the flaccid membrane, retained its function almost entirely.

The destruction of the membrana flaccida had been accompanied by a destruction of the head and neck of the malleus and the body of the incus; the manubrium of the malleus, however, remained attached to the membrana tympani. All the membrana tympani proper behind a line marked by a prolongation of the long axis of the manubrium was also destroyed, and the red, velvety mucous membrane of the tympanic cavity could be seen beyond. The condition of the stapes could not be made out.

The good hearing in this case, in spite of the great and peculiar destruction in the sound-conducting parts, must, I think, be accounted for by the free access the sound-waves had to the tympanic cavity, and both fenestræ.

CASE VI.—*Chronic purulent discharge from right ear, with polypus attached to perforation in back part of membrana flaccida.*—Miss D., aged twenty-five years, came under observation January 25, 1880. A slight purulent discharge was coming from the right ear. Upon inspection, a polypus was found attached to the posterior part of the membrana flaccida; the polypus being removed by Blake's snare, a perforation in this membrane was detected. The point of attachment was touched with chromic acid, in five days a little powdered crude alum was blown into the fundus of the ear, over the perforation, and with one or two repetitions of this, in less than a month the discharge ceased, and the perforation in the flaccid membrane closed. An interesting feature in this case, was that in *the left ear* there was a cicatrized perforation in the central part of the flaccid membrane.

The hearing in the right ear had not been affected by the disease, to any extent, which leads to the idea that the disease of the flaccid membrane in this case had arisen from without, and by erosion, as the patient had been in the habit of picking her auditory canal with pins and the like.

Of ten cases of perforation of the membrana flaccida, observed by the writer, six of which are presented in this paper, the following synopsis is given :

Sex..	Males, 7. Females, 3.	Position..	Anterior, 2 (in the double case, Case III., the perforations were anterior). Posterior, 3. Central, 3. Entire destruction, 2.
Ear..	Right, 5. Left, 3. Unrecorded, 1. Both sides, 1.	Cause.....	External (traumatic), 3. Internal (tympanic), 7.

In four instances in which there was marked tympanic disease with discharge, a polypus was found growing from the perforation. In the treatment of the tympanic disease, which is usually the cause of the perforation in the membrana flaccida, no means of cleansing and medication is so efficient as the tympanic syringe.

FATAL CARIES OF THE MASTOID.

By CHARLES S. RODMAN, M.D., of Waterbury, Conn.; with Remarks by J. ORNE GREEN, M.D.

I was called, on the evening of August 5, 1879, to see W. C. V., a pale, thin, undersized lad in his twenty-first year. By the history then obtained, he had been somewhat deaf from infancy, the degree varying with his general health, had been subject to attacks of pain in his head with nocturnal delirium, and occasionally there had been offensive discharge from the right ear. No physician had been consulted at any time, and his ears had never been examined by any aurist.

He had now been quite ill for two days, the attack having been considered to be identical with previous ones, though more severe. He complained of severe pain in the right temple and ear. Temperature 104°, pulse 135. There was no discharge at the meatus, but there was a large perforation in the drum-membrane and sligth tenderness over and just above the mastoid process. For two nights he had hardly slept, and had been slightly delirious.

A diagnosis was given of otitis media, with probable extension to mastoid cells.

Leeches were applied behind the ear, and bromide of sodium given. On the following morning he seemed better, having slept several hours; the pain was diminished, the pulse 100, temperature 102°. For ten days improvement continued until the morning temperature became normal, the evening, 99.5°. There had been no discharge from the meatus; appetite and strength improved under iron, quinine, and stimulants. The diagnosis of mastoid inflammation was so far modified, that his father, with him at the commencement of his illness, returned to his business in Chicago.

On the 16th there was an increase in fever and pain, with some tenderness, but no swelling behind the ear. An incision was now

made three-fourths of an inch behind and parallel with the concha, and the periosteum divided. The bone exposed was firm and healthy, and no pus was discharged, and no fistula existed.

On the 18th, about 8 A.M., he suffered a violent chill, lasting twenty minutes, high fever following; pulse running up to 140; temperature to 105°. Profuse sweating afterward occurred. Finding now slight swelling over the temporal bone behind the first incision, a second was made parallel with the first, and somewhat over an inch from the concha. From this, perhaps half a teaspoonful of offensive pus was discharged, and this continued to flow slowly, the incision having been filled with lint and red precipitate ointment. Quinine was ordered, 20 grains once a day. A chill of less severity occurred in the afternoon, one on the 19th, another on the 20th, followed by high temperature and profuse sweating. Suppuration appeared to be quite freely established on the 21st, and there were no more chills for some days. The boy meantime had become so deaf that it was difficult to communicate with him. His intellect was somewhat clouded, and perception dulled. He took stimulants and food in fair quantity; slept very well with the aid of chloral in 5 grain doses. Oppression of the sensorium with progressive emaciation made his condition most unpromising, when, September 1st, his father returned, and consented to have anything done which might afford an additional chance for life.

Dr. North was called in consultation September 1st, and on the following day, assisted by Dr. Munroe and myself, he removed a button of bone with the trephine, as shown in the specimen. Suppuration seemed to be quite free from the necrosed bone, but no marked relief followed, and the patient died in ten days from exhaustion, referred to the profuse suppuration and hectic fever.

At the autopsy only a slight congestion of the meninges was found; the brain was healthy. Pus had burrowed deeply in the muscles of the neck between the mastoid and styloid processes.

Remarks.

The specimen, consisting of the right temporal bone, is an interesting and, in some respects, an unusual one. The external sur-

faces of the petrous bone are normal in every respect. The inner surface of the mastoid, next the meninges, was extremely thin, but free from disease (the thin plate of bone had been broken after removal, but a note from the author says it was perfect when removed). At the extreme lower point, where the sulcus of the lateral sinus passes onto the base of the skull, the inner table is spongy and evidently carious over a slight extent of surface. The external table of the mastoid is wanting over a space about 27 mm. long, and 20 mm. wide where the trephine had been used. The whole inside of the mastoid is carious throughout, and contains several minute sequestra perfectly loosened, and the caries extends into the cancellated structure of the squamous bone, and there is a distinct line of caries along the inner surface of the suture next the parietal bone. The lower surface of the mastoid presents three distinctly carious perforations in the groove next the tip of the mastoid, *i.e.*, in the digastric fossa. The anterior one of these openings involves, apparently, the stylo-mastoid foramen, and all three of them communicate with the large carious cavity within the mastoid.

On exposing the antrum mastoideum and tympanum, the caries is seen to extend forward so far as to involve about one-half of the antrum, where the dividing line between the carious and healthy bone is perfectly defined. The remainder of the antrum and the tympanum proper are free from any disease of the bone; the soft parts within the tympanum had been so injured by worms, that it is impossible to speak of their condition.

From the history of the case, and from the specimen, it is evident that there was a caries limited to the inside of the mastoid, and produced by a chronic, purulent inflammation of the tympanum; but, instead of nature seeking relief, as is usual, by perforation of either the outer or inner table of the mastoid, the base of the mastoid was the first to be perforated, and there was the gravitation of pus into the deep muscles of the neck. In this respect the case is unusual. It is also of great interest as showing how the mastoid disease, although secondary to the tympanic inflammation, becomes the important feature in a case, and how a caries may be entirely limited within the mastoid itself, *i.e.*, within the mastoid cavity, without producing external periostitis.

IMPACTED FOREIGN BODIES IN THE EXTERNAL AUDITORY MEATUS.

By FRANCIS H. BROWN, M.D.,

BOSTON.

I WISH to discuss, very briefly, the presence in the external ear of a series of foreign bodies which from their size nearly or entirely correspond with the extreme calibre of the meatus, and especially of those of a vegetable character, which expand by moisture and hence are liable to become, to a greater or less extent, impacted.

The view which I entertain is, to a certain extent, in opposition to that expressed by writers on the subject, but I think a word may fairly be said for what seems to me the rational treatment of such cases.

Judging from the remarks of some authors, the meatus auditorius is looked on as a *terra incognita*, much as the colon or the pleural cavity would be, and its investigation to be entered on as we should that of any of the inner organs of the body. Every practitioner should, on the contrary, recognize the fact that the entire passage of the outer ear is within his sight and that the treatment of its diseases should be governed by the same rules which would dictate his care of any other portion of the body's surface.

In looking over the works of various authors on aural surgery I find a marked sameness in the ideas expressed by them ; the same list of foreign bodies is given in detail ; the same cases, some important and many unimportant, are referred to and passed from one to the other ; while the same line of treatment, whether wise or unwise, or failure to treat, apparently becomes hereditary to each new writer on the subject, and is deemed the canonical method. The foreign bodies which particularly claim our attention now are those vegetable substances, such as beans, peas, and kernels of corn, which nearly occupy the passage at the first, which become swollen, and

thus more serious intruders by their increase in bulk. For the removal of such foreign bodies the syringe, probe, curette, and similar instruments often prove of no avail, though of frequent use in the elimination of loose substances. The successful use of the syringe (and I certainly agree with all authors, from the earliest to the most recent, that this method of elimination is, without doubt, the best when it can be employed) implies a comparatively loose body, certainly one which does not entirely close the meatus, and which allows either the nozzle of the syringe to be insinuated, or the stream of water to be forced beyond it. In all such cases the *vis a tergo* offered by the water can seldom fail to bring out the foreign body.

Dr. Dewitt somewhat quaintly remarks, "The surgeon should always make certain, by an examination with the speculum, that there *is* a foreign body present before he begins poking instruments into the ear, remembering that a late eminent hospital surgeon is said to have dragged out the stapes while fishing for a small nail which was not in the ear at all."

The point I wish to make is that tightly impacted bodies in the ear *must* be removed; that the practice of allowing them to rest, even in cases where no apparent and immediate irritation or inflammatory action are present, does not offer assurance that subsequent trouble will not arise, and, in fact, that at some time or other, with the accumulation of cerumen in the ear, with the access of a cold, or by some other means, the meatus is very likely to take on inflammatory action, in which case the integrity of the middle ear may be jeopardized. If the body is firmly impacted in the ear from the first its very presence and pressure induce œdema of the meatus, and the longer it remains, the more unsatisfactory will be the attempt to remove it.

Gruber, in the *Wiener medizinische Zeitung*, advises extreme caution in extracting foreign bodies, and follows the advice of Dieffenbach and others, to allow them to remain an indefinite time, until swelling is reduced and suppuration has, to a certain extent, ceased. It must have occurred to the learned otologist that a collection of pus behind the body would act seriously on the membrane and might cause grave injury to that portion of the ear, as

well as to those more central still. I cannot help feeling that the foreign body, while it remains within the meatus, must be a constant source of irritation, and no delay whatever will release a body which is actually firmly impacted.

A writer in the *Dublin Medical Press*, of January 27, 1864, says: "Beyond a forceps, an ear-scoop, with a long handle, and a small cork-screw, almost all the instruments recommended for this purpose are, more or less, toys or dangerous. . . . . If the gentlest endeavor (or syringing), during which the eye guides the hand, do not succeed, the body should be left in the ear—aye, 'even were it a dagger's point'—and, strong as the expression seems, the author justifies it by reference to cases on record in which pointed bodies have remained for years in the ear with impunity. . . . Leaving the body in the ear then, warm water syringing and soft poultices are to be resorted to until the ensuing suppuration loosens it and gives it a new direction." Von Tröltsch says: "Generally the presence of these bodies in the ear is less injurious than the attempt to remove them."

As examples of what may be expected when such foreign bodies are allowed to remain, Mr. Hutchinson speaks of a child with a locust bean in its ear, "which it has been found impracticable to remove. After persevering attempts he tried his favorite method with a loop of wire, but found it impossible to get the wire round, as the bean had swollen and filled the cavity. A second attempt was made in a few days with a like result. A week later the child was feverish and had much pain in the head. Then paralysis of the portio dura came on."

Lowenburg, in his paper on the agglutinative process, announces that the vast majority of practitioners are unable to use the ordinary instruments for extracting foreign bodies from the ear without injury to the patient, and narrates many cases to prove that not only the patient suffers more from attempts at extraction, but that it not infrequently happens that the surgical interference has been applied to the wrong ear, and states that children have been brought to him with the right ear inflamed, as the result of manipulation on the part of friends or inexperienced surgeons, while the foreign body was lying unnoticed and harmless in the left ear. He

would exclude all instrumental interference with foreign bodies, and would confine himself solely to the use of the syringe or the agglutinative method, a process which he claims was employed by Celsus (Lib. VI., cap. 7). It must be remembered, however, that there are cases in which the pressure on the lining membrane has been so great as to cause a burr of an œdematous character, which the feeble traction of the agglutinative process would have no power to overcome.

As indicative again of the caution which it is necessary to use in the treatment of the ear, Sir Benjamin Brodie speaks of a child with a pea in its ear, in which the membrana tympani was broken in the attempts to extract it, and death ensued. On examination of the body after death the membrana tympani was found to have been destroyed by the violence which had been used, the pea had been forced into the tympanum, and the rough usage of that cavity had caused inflammation, which had extended to the membranes of the brain.

The whole series of forceps, from the crude instruments of the earliest surgeons to those of the present day, are manifestly unfit for securing a firm grip on a foreign body which presents but a small part of its surface, and that a convex one, to their grasp. To this remark I make the one exception of the Tiemann bullet forceps, so successfully used in the late war of the rebellion, and its smaller form, which finds a place in some of the pocket cases of the present day. In this instrument the teeth are set in such a manner that even when only a small part of the foreign body can be reached, they can be firmly engaged in it and a considerable extractive force can be employed. It will be remembered that a trifle more of space is obtained and the ease of extraction increased in the case of a tightly fitting body, if the patient is caused to open his mouth during the process, an experiment which any one can try by putting his little finger in his ear.

Were it not recommended by such a man as Von Tröltsch, it would seem the height of barbarism, as well as utterly futile, to make an opening into the auditory canal behind the ear, and indeed, as the body is generally deeply inserted, it is difficult to see how such a manœuvre could be of any practical utility, but Von

Troeltsch distinctly says (*Hay's Journal*, XLVIII., 394), "If a case came under my observation where an impacted body produced such symptoms as to indicate an energetic mode of treatment for its removal, and delay was not practicable, I should hasten to extract it by an operation, by making an opening through the wall of the meatus, so as to admit of its being approached and seized from behind." As Dr. Gross says, "The idea of separating the auditory canal from the squamous process of the temporal bone, with a view of obtaining access to the extraneous substance, as suggested by Von Troeltsch is so absurd that it ought to be ranked among the exploded notions of the barbarous ages."

To bear me out in my view that an impacted body, of the kind mentioned, should be extracted from the ear, if, by any possibility it can be accomplished, the remarks of three authors are in point. Nottingham, in his "Diseases of the Ear," says: "A seed, or other vegetable substance, capable of expansion, not to say of germination, should not, on any account, be allowed time for the alteration alluded to; for the suffering produced by any body of the kind, expanding within the deeper and unyielding part of the meatus, and hence pressing upon its highly sensitive surface, is of a most disturbing, not to say maddening character."

Voltolini mentions the fact that the "lining of the meatus is of great importance; for while the cutis, as long as it covers the cartilaginous portion of the meatus is 1.5 mm. in thickness, as soon as it passes on to the bony portion of this organ, it becomes suddenly only 0.1 mm. or fifteen times less thick, and so intimately and firmly is it here united to the periosteum that it comes away with the periosteum from the bone rather than admit of being separated from it, so that the important result occurs that every inflammation of the cutis is also a periostitis, and the covering of the meatus may be easily injured, leaving the bone bare." Voltolini has used the galvano-cautery in these cases with the best effect. Employing the finest points he gradually burns a hole through the foreign body, which, being thus broken up, is easily removed.

Guersant, in a number of the *Bul. gén. de thérapeutique*, says, "All these foreign bodies, when they remain in the auditory canal, principally those which swell up, may occasion severe acci-

dents, such as inflammation, suppuration, cerebral symptoms, meningitis. Hence it is important to relieve, as soon as possible, children who have in their ears a pea or a seed which may swell up on becoming moist."[1]

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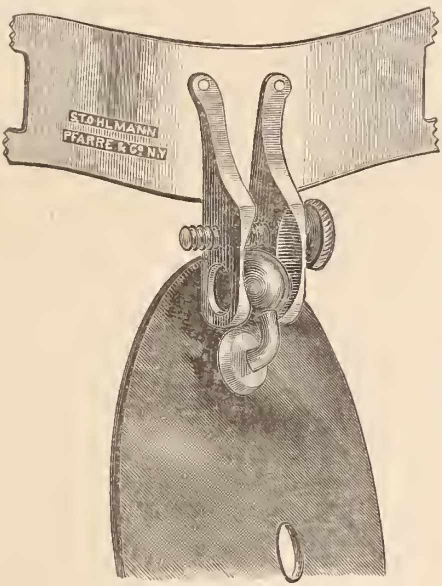
[1] Since the above article was sent to the printer a case of impacted foreign body has occurred in a patient of Dr. C. J. Blake. He kindly asked me to see it with him, and has allowed me to mention it. F., a clergyman's child, five years of age, presented himself, having a foreign body of considerable size deeply and firmly impacted in the ear. The syringe, curette, aud other instruments had been applied without effect. The foreign body presented a couvex surface of limited extent, on which ordinary forceps had no hold. It was found to be immovable. The child was etherized, a strong ray of light was thrown into the ear by the frontal mirror, and then, by the aid of the Tieman forceps, Dr. Blake removed a full-sized kernel of corn. The well-marked burr, to which reference was made in the article, had formed both before and behind the foreign body. The condition existed which has beeu already described. The body had been so firmly forced into the ear that pressure was exerted on the lining membrane, and a burr of œdema had ensued. This iu itself would go far toward preventing examination of the body by ordinary means. Moreover, the pressure on the thin cuticle could not fail of inducing inflammation of the periosteum immediately beneath it, and the occlusion of the meatus would imprison any secretion which might be formed and render it impossible to observe changes occurring near the membrane. Under these conditions and liabilities forcible extraction was urgently called for.

A MODIFICATION OF THE EAR AND THROAT MIRROR.

By OREN D. POMEROY, M.D.,

NEW YORK.

The above mirror is a modification of the one sold in the shops in New York, under my name. A mirror somewhat similar to the old one was devised by Dr. R. F. Weir, of this city.



I had objected to the mirror formerly in use, on account of its lateral movements being too limited, the clamp holding the ball striking against the back of the mirror when the excursions were carried too far to either side. I had diminished this objection by bevelling the edges of the clamp, and applying a milled head-screw to hold the clamp, but still the movements were too limited

to satisfy me. I always have been an advocate of looking through the aperture of the mirror, and to do this comfortably the latter needs to move very far in every direction. The cut will readily show how very complete mobility is obtained. The old instrument had the ball attached to a stem which projected from the back of the mirror at right angles to it. The one under consideration has a somewhat longer stem, which is bent so that the ball points directly upward, allowing the clamp to swing completely around in the horizontal meridian, without once striking the back of the mirror. As some prefer the mirror to be placed above the eyes, against the forehead, the clamp is so bevelled as to allow of this adjustment.

Others prefer the mirror to be placed below the eyes, but this instrument cannot be adjusted to that position for obvious reasons. This mirror was found to have a limited movement from side to side—that is, as a pendulum would move. That objection was met by deeply bevelling the ends of the clamp. As now arranged, this appears to me a very perfect instrument. Great care has been taken to make the aperture in the mirror of sufficient size so as not to be obliterated when it is turned far to one side. The mirror is ground from very thin glass so as to have slight depth of border to the aperture, giving less opportunity for annoying reflections of light at its borders, besides being well covered with a dull black coloring matter to still further avoid reflections. The metallic portion, or backing of the mirror, should have a larger aperture than that in the glass. I am not at all in favor of using the mirror without a perforation in the glass, for many reasons which seem to me satisfactory. The forehead-band is made of inelastic material, as being more durable than the gum-elastic bands formerly in use, and more agreeable to the head—the continuous pressure of the rubber band being, after a time, quite annoying. This band may be made of strong silk or muslin, or even of thin and flexible leather; or the portion attached to the forehead-piece of hard rubber may be made of strong leather, as is the case with the mirror used by Dr. Buck of this city, as this is the portion soonest worn out—besides the mirror is held more firmly on the forehead by the material of the band being rather stout in this portion. I use a

mirror of from six to eight inches focus, as artificial light is generally preferred by me. If daylight is used, a focus of nearly or quite double this should be employed. The throat men prefer a pretty long focus to the mirror.

The clamp being made of metal is much more durable than the hard rubber sometimes used. The forehead-piece is sometimes padded, but that seems to me to be unnecessary, and it is an annoyance, as it frequently wears out. As at present constructed this mirror seems to me to have reached a maximum of durability. I do not recommend a separate handle for examining while the instrument is held in the hand, as it is wholly unnecessary and complicates the instrument, it being held in the hand perfectly well by the forehead-piece. When critical examinations of the ear are made for purposes of diagnosis, it seems to me more agreeable to hold the instrument in the hand, and not to place it on the forehead. This instrument is most admirably made by Stohlmann, Pfarre & Co., of New York.

BOOK NOTICES.

Primordialbrusken og dens Forbening i det menneskellige Kranium for Fodselen. (The primordial cartilage and its ossification in the human cranium before birth.) By Dr. Adolph Hannover, Copenhagen, 1880. 180 pp. 2 Pl.

The first twenty-four pages of Hannover's monograph contain a historical and critical review of the works of prior investigators. The author successively gives the views of Dugés, whose researches, according to Kölliker, gave the point of issue to the results later obtained by Rathke and Jacobson, and who first used the name "primordial" in connection with the cartilaginous part of the cranium; Rathke; Jacobson, who applied the name of primordial-cranium to the morphological foundation of the cranium; Eschricht; Spöndli, who gave the first detailed description of the primordial cranium and its ossification in different mammalia and in man, and who justly made the observation, that it is not right to speak of the primordial cartilage in the cranium, as if it were a connected whole, but rather of parts or regions within the cranium, the limits of which appear more definitely with the extension of ossification. We meet further Kölliker's first investigations, undertaken with Spöndli, but published some years later, Bidder and Reichert, the later researches of Kölliker, H. Müller, Betz and Meyer; the former inclining to the views of Kölliker, the latter supporting Reichert, Bruch, Virchow, and Gegenbaur. A critical review is given of the views of these authors, and the general observation made, that, what hitherto was called intracartilaginous (enchondral) ossification, is only a calcification, while real ossification—from bone corpuscles, which can only with certainty be stated from microscopical examinations—occurs always, at least in the higher vetebrata, through the medium of the perichondrium or periosteum.

The second chapter, seventy-two pages, contains the examination of twenty-five human embryos of from nearly two to eight months, with that of some details in an additional fœtus of the same age. In the making up of this series the size is taken into consideration as well as the age, so that the series is a continued one in both regards. The longest longitudinal and transverse diameters of the head are given for every fœtus. The measurements, expressed in millimetres, are intracranial. The longitudinal diameter is taken from the region of the protuberantia occipitalis interna to the anterior edge of the lamina cribrosa, so that the pars nasalis, which belongs to the primordial cranium, but lies outside

of the cranial cavity, is not included in this measure. While Löwe found the auricle in visible formation in a fœtus only one centimetre long, in Hannover's first two cases there was, with a length of twenty-seven and twenty-eight millimetres, no vestige of external ear, or it was hardly distinct.

The third chapter contains the deductions made from the preceding examinations, and consequently the author's views on ossification in the primordial cartilage of the cranium. We propose to give here the general results of his researches, and in regard to the detailed description of the ossification in the cranial bones separately, to mention only those which will be of special interest to the readers of this journal, the os temporale and ossicula auditus.

The cartilage which surrounds the chorda dorsalis, forms probably in the earliest stages one coherent mass, in which subsequently the separate vertebræ are formed. The cartilage does not completely surround the chorda, but is wanting at the dorsal side, so that the backward growing vertebral arches are, at first, not united in the median line of the back. In the same manner the cartilage which belongs to the cranium is open backward and the roof of the cranium is membranous to greater or less extent, for a certain time, while its fundus is formed of cartilage. This cartilage appears first as a coherent mass, but of different thickness in different places, and already, before the end of the second month, the subsequent form of the bone is distinctly indicated, but without the definite limits that are later given by different sutures. This primordial cartilage gives the foundation for the os occipitale, os sphenoideum, os ethmoideum with the conchæ infirmæ, the ossa temporalia and ossicula auditus. All the other bones have no such cartilaginous foundation, but they are formed through membranes of connective tissue, while the limits of each single bone are more or less distinct from the outset.

The manner in which a bone originating in the primordial cartilage forms, is different from that in which a bone is formed from membranes. In the cranium, as in other parts of the primordial skeleton, columna vertebralis or extremities, there are several points of ossification which afterward connect. But a bone which forms in membrane has but one point of ossification, or at least but one cardinal point to which, during the progress of development, sometimes secondary points are added. There also is a difference in the points of ossification themselves, for in the bone which forms in membrane they begin with an extremely thin scale, while in the primordial cartilage they possess different forms, but always a certain thickness, and as they are not formed on the surface they are always surrounded by cartilage. These differences show not only in the bones, which owe their formation to membranes, like the os frontale, parietale, and all bones of the face, but the same obtains with parts of the bone, which afterward unite with bones formed in the primordial cartilage. All the latter bones connect with bone substance formed in membrane, and only after this connection is their form completed. So, for instance, in the os occipitale the part which lies anteriorly and superiorly to the

linea semicircularis superior is not formed in cartilage, but in membrane. In the os sphenoideum the same occurs with the cornua; in the os ethmoideum the lamina papyracea; in the os temporale the entire squama, the anterior part of the tegmen tympani, and the meatus auditorious externus. Among the ossicula auditus the processus longus mallei is not formed from cartilage, while the processus Meckelii, which is present in the primordial cartilage, disappears before the end of gestation.

Histologically, the result of both formations is the same when completed, as no difference in bone corpuscles can be shown. H. Müller was the first to observe that, as well in the original as in the calcified cartilage, there appeared canals, partly filled with narrow cells, partly with nuclei. These nuclei supply material not only for the stellate bone corpuscles, but also for the intermediate bone substance, and the same nuclei he has shown to exist in the connective tissue which forms the periosteum. Gegenbaur has called these nuclei "osteoblasts."

For the purpose of examination Hannover recommends a fœtus three months old, in which the different periods of ossification can be followed up in the lower part of the squama occipitalis, the pars basilaris, the semilunar ossification back of the condyli, the alæ magnæ, etc. The name of ossification is here used in a general sense, for originally it is calcification, although ossification rapidly follows, and only microscopical examination can show the difference, as bone corpuscles only justify the diagnosis of ossification and are entirely different from calcified cartilage-cells.

In a perpendicular section of the cartilage in the lower part of the squama occipitalis we find at the outside a periosteum, which afterward receives the name of galea aponeurotica, consisting of fine, smooth, straight or but slightly curved fibres, mixed with small, oval or shuttle-form nuclei, which provide material for the future osteoblasts. The most external layer has fewer nuclei and appears more like real connective-tissue fibres, but with less pronounced curves. Under the periostenm is an extremely fine membrane, which shall later be described. At the surface which is directed toward the brain, the cartilage is covered with a very thin layer, containing few fibres, often with a granular surface; this layer is also mixed with a number of small, round, or oval nuclei, of which some are larger than the others. This layer is more closely connected with the cartilage than the outside periosteum, and does not appear to be transformed into the dura mater, which has coarser fibres, smooth, stiff, glittering, without nuclei and occasionally running crosswise. This proves that the periosteum at the inside of the cranium does not depend for its formation upon the dura mater. Between these two there can be observed with a microscope a sharply defined layer consisting of medium-sized cartilage-cells. Before the process of calcification begins the cartilage-cells undergo a change. They become more transparent and two, three, or four times as large as before, probably at the cost of the clear intercellular substance which surrounds them. Each

cell is round or oval, rarely angular. They are surrounded by a solid cellular membrane, which shows a clearly defined double contour. Sometimes one meets with cells, the contents of which have escaped from the capsule or empty capsules, a proof that both possess a certain consistence. Within the clear cells are one or two, rarely three, relatively small, round or slightly oval, finely punctated or granular nuclei; their size is not proportional to that of the cells. Two cells united in one common surrounding are rare. The more one gets away from the part of the cartilage, which will be calcified, the less numerous the cells become, and gradually they pass over into the same cells, which are found in the rest of the hyaline cartilage.

When the period of calcification draws nearer, the capsules begin to thicken and show several sharply defined layers. These can be isolated, and as before, there can be found capsules, isolated and thickened, and cell contents, without capsule. The capsules are situated concentrically around the cartilage-cells. The nearer the point of calcification the darker are the nuclei of the cartilage-cells and the thicker the capsules.

The next phase is the calcification of cartilage-cells. This occurs by the deposition of a calcareous mass, of glistening appearance and crystalline form, in large or small pieces. These depositions always occur first in or around the concentric capsules; they are covered and thoroughly penetrated with the calcareous substance, but the cartilage-cell is free. When all the capsules are calcified there results a network, the meshes of which become gradually smaller with continual deposits of the substance. But still the cartilage-cells can be recognized in the midst of these meshes, and if muriatic acid be added, the lime salts are dissolved with development of gas and disappear completely, while the entire masses of cartilage with cells, capsules and nuclei, remain, and, with the exception of being somewhat paler, appear unchanged. The more recent calcification is, the more complete is this appearance, but in older calcifications it is somewhat diffuse, the capsules are devoid of their striped appearance and the cells are more or less distinct. The nuclei retain their round form. Of bone corpuscles not the slightest trace can be found in the calcareous mass.

The next stage consists in the dissolution of the entire calcareous mass. This can be best examined in the lower part of the squama occipitalis in a three months' fœtus. After making a perpendicular section and removing the periosteum from out and inside, there are observed two dark stripes, enclosing a light, nearly transparent stripe in the middle. The two dark stripes are in reality bone with bone corpuscles, which are seen at the edge, and lie in rows, as the structure is lamellate. At their inside are found shuttle-form or large, oval nuclei, pointed at both ends, exactly of the same nature as the osteoblasts, which the periosteum supplies. They have, in fact, the same origin, as they are derived from the external periosteum, which from the outset penetrates within the calcareous mass to form the Haversian canals, which are

provided with nuclei. Where the osteoblasts are collected at the surface of the layer, is found a vertebra-like deposit of them, and later of bone corpuscles. The youngest corpuscles are large, clear, and without granules, but in growing older they become smaller, but more and more granular. This can be observed as well in the middle as at the edge of the ossification, where the bone corpuscles are large and light. Those on the anterior surface appear to be younger than at the posterior surface. In the middle stripe is a sparse, undefined, fibrous tissue, with small nuclei. These may be the remnants of the striped capsules and nuclei of the cartilage-cells, but they do not look like the large, oval osteoblasts, and there are no transitions between them.

Another part of the cranium, where it can be proved that the nuclei of the cartilage-cells have nothing in common with the osteoblasts, is the pars basilaris occipitalis. In a three months' fœtus this part is 1.25 mm. long, 0.5 mm. wide, and 0.25 mm. thick. After removal of the periosteum there can be separated as well from the upper as from the lower surface an extremely thin, transparent bony scale. It consists of real bone, and contains one single layer of numerous large, light bone corpuscles, pointed at the ends, but hardly granular, reposing in a slightly striped fundamental substance, here and there with the indication of a concentric deposit of bone corpuscles. This depends upon the fact that in such a place a Haversian canal has penetrated from the outside. The corpuscles are most numerous in the lower surface. Between the thin bony plates is a porous, opaque, whitish, calcareous mass. If this be dissolved in muriatic acid, the large cartilage-cells make their appearance the same as described above. If the external bony scales are dissolved, the bone corpuscles disappear, and their former places can only indistinctly be traced as light spots in a uniformly clear fundamental substance. In the centre there is calcification of the enlarged cartilage-cells; at the periphery there are formed bone corpuscles, and this formation goes hand in hand with the calcification of the cartilage-cells, so that near the bony scale can be found the enlarged cells, which are still distinct, though partly covered by a calcareous mass. At the outside of the bony layers bone corpuscles are continually formed from osteoblasts, wherewith the inside of the periosteum is provided. For the formation of the bone corpuscles in the inside of the calcareous mass, the osteoblasts serve, which enter with the Haversian canals, and the calcified cartilage between the bony scales gradually disappears.

A third place where this process can be studied is in the tip of the ala pterygoidea interna, which subsequently becomes the hamulus pterygoideus. It is seen best in a five months' fœtus. In this formation the same microscopic preparation may show bone corpuscles formed from osteoblasts, and next to them cartilage-cells with their nuclei, without any transitory forms between these elementary parts.

The ossification in the cartilage begins with a deposit of calcareous matter in some definite points, called points of ossification, a name which is inappro-

priate in regard to the cranial cartilage in the first period of the process, when no bone corpuscles are yet formed. In the membranous cranium these points are ex incipio points of ossification with bone corpuscles, in the cartilage of the cranium they are only points of calcification. These points of calcification start from the centre of the cartilage and not from its surface, exactly as is to be found in the vertebræ, in which the point of calcification always lies in the centre of the corpus vertebræ. It is difficult to demonstrate this in the cranium on account of the thinness of the cartilage, yet Hannover has found points of calcification in the centre of the cartilage of the corpus sphenoideum, in that of the malleus and incus, and likewise in microscopical sections from early periods in the pars basilaris occipitalis. Next, the points of calcification increase in size, easily distinguished by their whitish color, especially after the cartilage becomes dry, and push outward to the surface of the cartilage. After this has happened, the perichondrium grows together with the point of calcification, and now this point becomes a point of ossification. For the perichondrium deposits its osteogenous nuclei or osteoblasts, which become bone corpuscles. The perichondrium changes its name, but not its nature or its function, and is now called periosteum. From this period the connection between periosteum and cartilage becomes more firm through continued formation of bone corpuscles, so that it can no more be separated from the cartilage as before, without injury. The more ossification progresses, the firmer this connection, as can be seen at the bottom of the sella turcica. The periosteum provides not only nuclei for the surface of the point of ossification, but at the same time begins the forming of the Haversian canals, which are in reality offshoots of the periosteum to the inner part of the cartilage.

Hence it follows that a true intracartilaginous ossification does not exist, but that every ossification (that is formation of bone corpuscles), as well in the internal part of the cranial cartilage as at its surface, proceeds in that manner to which hitherto the name of periosteal ossification has been applied. Hannover only applies this conclusion to the ossification of the primordial cartilage in the human cranium, but has no doubt that the same can be applied to the entire primordial skeleton of man.

In the membranous portion of the cranium the ossification is ex incipio periosteal. The nuclei in the connective tissue, which form the periosteum, become bone corpuscles, as can be observed in different transitory forms, and gradually the tissue is penetrated by a calcareous mass, and the separation of the different layers of the membranous cranium becomes more difficult. In regard to the manner in which the separate bones of the cranium are formed from the primordial cartilage, the following is observed in relation to the os temporale and ossicula auditus.

The os temporale is formed in four parts. Of these the pars mastoidea and petrosa belong to the primordial cartilage, while the annulus tympanicus, with the later meatus auditorius externus, and the pars squamosa, with the anterior

part of the tegmen tympani and the processus zygomaticus, form from membranes. The two first parts are from the onset, and even at the time of birth, not completely united with the two latter. Like the os ethmoideum, a part of the cartilage for the os temporale has a greater extent than the later bone, as the processus petroso-parietalis and petroso-occipitalis disappear. That the completed form of the pars petrosa differs so much from that of the cartilage, is caused by a strong intramembranous ossification at the outside, especially on its lower surface, which ossification afterwards connects with that in the cartilage.

In the two and a half months' fœtus the pars squamosa is not formed. The first ossification is found at three months, when between two membranes is found a little bony plate, with a lower straight and upper convex margin. Sometimes, however, at the same age there is only the form, but without ossification. The proc. zygomaticus is found ossified at four and a half months. The pars squamosa, during its growth, lies outside of the cartilage for the pars mastoidea, and in the five months' fœtus its lower margin covers the fossa, in which the ossicula auditus are developed. In a fœtus five and a half months old, it can be seen that the strong periosteum of the pars mastoidea, in the vicinity of the posterior margin of the pars squamosa, divides in two layers. One layer covers the pars squamosa at the outside, the other runs to the inside between the pars squamosa and the cartilage, the former distinctly overlapping the latter. The internal layer next leaves the cartilage, and lies outside of the dura mater, with which it is connected. Yet it can, especially at the first, be easily separated therefrom on account of its thickness and firmness. They subsequently grow together, and no separation can take place, and the dura mater, or rather its outside layer, assumes the function of periosteum for the inside of the pars squamosa.

The annulus tympanicus can, in a fœtus of two months, and even less, be loosened as a tendinous thread. The first distinct ossification occurs in a fœtus of two and a half months, in which is formed an ossified, elastic, upward-open half ring, the thickness of a fine silk thread. At three and a half months the anterior ends of the half ring are larger. While the whole thread increases in thickness, the groove in which the membrana tympani extends appears, and at five months the anterior end is enlarged in the form of a spatula. That part which stands in connection with the internal edge of the half ring carries upward a furrow, in which the proc. Meckelii and the proc. longus mallei are situated. Subsequently the half ring becomes thicker and larger, and closes more at the top, but at eight months it can still be entirely separated from its surroundings.

The pars mastoidea originates in a part of the pars occipito-mastoidea of the primordial cartilage, and shows the relatively large foramen mastoideum, which opens in the sinus transversus, indicating nearly the limit between the pars occipitalis and mastoidea. It is quite distinct at two and a half months, and its limits clearly defined at three months, showing as a shallow furrow in

the cartilage. A peculiar relation obtains in the ossification of this part. It ends downward and forward in a cartilaginous processus mastoideus, which is indicated at two and a half months, has quite a thickness at four months, and a whitish appearance at four and a half months. But the entire relation of the pars mastoidea with the processus mastoideus to the pars petrosa is different from what shows in the adult; whereas in the adult there exists a distance of about one inch from the place where the canales semicirculares project from the os petrosum to the outside of the processus mastoideus, the cartilage, which becomes the pars mastoidea, lies before birth back of the semicircular canals. Through this arrangement the canalis semicircularis inferior and externus can supply points of ossification for the pars mastoidea. At five months there can be seen downward, and slightly before the foramen mastoideum, a whitish, perpendicular, oval plate, which is the commencement of ossification in the canalis semicircularis inferior; a thinner, horizontal, oval plate, the anterior end of which is bent upward, is found outside of the former, as an indication of ossification in the can. semicircularis externus.

In some embryos of this age there is no bone formation, but in others it may be seen that the canalis semicircularis inferior is formed inside the cartilage, and shows as a bony knob on its surface, while the canalis semicircularis externus is at this time less distinct. At seven and a half months this knob had changed to an oval, flat projection. Outward and forward of this bony elevation the cartilage was covered by the ossified pars squamosa, being separated from it by the periosteum, as was mentioned before. The ossification of the pars mastoidea is continued after birth.

The pars petrosa forms a connected mass with the remaining cartilage, as can be recognized in a fœtus of two months or less. It can be distinguished by the round, porus acusticus internus and the foramen lacerum, the latter showing as a split between the pars petrosa and basilaris. At a little over two months the canalis semicircularis superior appears, and shows an excavation filled with a fibrous mass under its arch (fossa subarcuata, v. Tröltsch).

In fœtuses of this age there are sometimes seen on the lower surface two very flat elevations, three mm. long, for the cochlea. In fœtuses of two and a half months the pars petrosa forms on its upper surface a swelling, forward thin and backward thicker, with a large porus acusticus internus, in which a separation can already be recognized; also the internal part of the cochlea begins to show divisions. The fenestra rotunda appears as an excavation, running downward and backward. Both fenestræ are distinct in three months; the cochlea only contains small cartilage cells; the canalis semicircularis superior projects further. The fossa subarcuata is as large as the porus acusticus internus, and at three and a half months a cartilaginous excavation may be seen back of the fossa. At four months the entire pars petrosa has increased visibly in size; the club-shaped anterior end is on its upper surface, attached to the lateral part of the pars basilaris by a fibrous covering of the thin cartilage,

while the foramen lacerum separates them further back. From a greater projection of the canalis semicircularis superior the posterior part of the pars petrosa is larger; the upper and external half of the canal is twice as thick as the lower internal half; back of the canal there is in the cartilage an opening for a vessel. The cartilage passes over backward in the pars occipito-mastoidea, at the inside and in front of the processus mastoideus. The cochlea has a flask-shape, and is directed inward and forward, and the oval window is separated by a ridge from the round window which lies underneath.

The ossification begins in the five months' fœtus, in the upper edge of the porus acusticus internus, which first becomes white and subsequently ossifies. Later the ossification extends over the canalis semicircularis superior, and thence in a seam of cartilage, which is found at the external edge of the pars petrosa and forms the posterior part of the tegmen tympani. The canalis semicircularis superior is at first only whitish, and consequently becomes ossified a little later than the canalis semicircularis inferior and externus, the ossification of which at five months has already been mentioned in connection with the pars mastoidea. Simultaneously the ossification begins in the cochlea, the cartilage of which has already, at four and a half months, become harder than that of the canalis semicircularis superior. In a five months' fœtus there is formed in the posterior third of the cochlea a bony scale, which surrounds the fenestra rotunda, and is especially thick back of the fenestra, from whence it stretches with a sharp border to the cartilaginous processus mastoideus. Around the fenestra ovalis there is only a thin and small bony scale, from which a thin lamina extends to the inside of the fenestra. Upward these bony scales form a fossa, wherein the upper part of the ossicula auditus is situated. Up to this time the two external thirds of the cochlea are still cartilaginous. The fossa subarcuata with its cartilaginous pyramid provided with several small openings, fills up, as the fibrous mass, by which it is occupied, spreads outward and in the same manner the excavations on the posterior surface become more shallow. At the end of five and a half months, or in a large five months' fœtus the entire anterior part of the os petrosum is in progress of ossification, the three semicircular canals, the surroundings of the porus acusticus internus, which has diminished in size, the posterior part of the cartilage seam at the outside of the pars petrosa, which is still unconnected with the pars squamosa, the surroundings of the hiatus canalis Fallopii and of the fenestra ovalis and rotunda. The cochlea, which has still retained its flask form, is rough and uneven at its lower surface from a deposit of intermembranous nature, so that the periosteum can only with difficulty be removed. As far as could be proved with a needle, all parts of the internal ear were ossified. But there is still cartilage in the fossa subarcuata, which now forms a flat pyramid with different small openings, and from there the cartilage extends in the processus petrosa-occipitalis and petroso-parietalis, as will be later explained. There also exists at this time a thin, cartilaginous connection between the pars

petrosa and the lateral edge of the pars basilaris, which is covered with a thick, fibrous mass.

At six and a half months the ossification extends in a radiated form behind the canalis semicircularis superior upward, and at seven months the bottom of the fossa subarcuata becomes ossified and the rest of the cavity filled with a fibrous mass. Cartilage may, however, be found yet in older fœtuses. The cochlea still retains its flask form, but is rough and angular on its surface, and its projections are further developed in a seven and a half months fœtus. The flat ossification, which the canalis semicircularis inferior and externus form together at the outside of the pars mastoidea, passes over forward and outward in the ossified cartilaginous seam at the outside of the pars petrosa. This seam, as was already mentioned, forms the posterior part of the tegmen tympani; the anterior part is formed intramembranously, like the adjacent pars squamosa. At eight months the pars squamosa had not yet grown together with the ossified seam of cartilage.

The fenestra ovalis forms in one piece with the stapes, as will be later described with the ossicula auditus.

The fenestra rotunda shows first in a two months' fœtus as an excavation in a little elevation. At three months it is completely formed, but even at four months not so sharply defined as in the adult. Ossification over its entire extent is seen at five months.

The aditus ad aquaeductum vestibuli is distinct in the fœtus of two and a half months, and forms a little perpendicular slit in the cartilage, which at first is covered with a cartilaginous valve. This can later remain or continue as a small elevation, under which a little flat surface leads to the aditus. It becomes ossified at five months.

Canalis Fallopii. The hiatus canalis Fallopii is seen in the two and a half months' fœtus, as a relatively large, oblong opening in the upper surface of the cartilage, descending perpendicularly; the opening retains its size, which only diminishes with beginning ossification at five months, when a furrow is formed in the bone. Its size was considerably diminished at seven months. The canal is comparatively shorter than in adults. The prominentia canalis Fallopii shows at two and a half months, becomes ossified at five months, so that at seven months it is surrounded by a thin bony scale, but still cartilaginous inside. In a four and a half months' fœtus a small, round foramen, stylo-mastoideum, was found, completely imbedded in the cartilage in front of the small processus mastoideus.

The canalis caroticus appears as a furrow in the lower and anterior end of the cochlea at five and a half months, is ossified at seven months, but its external wall does not seem to be formed in the primordial cartilage.

The fossa infundibuliformis was distinct in a fœtus of four and a half months. An intermembranous ossification in the external wall of the foramen jugulare is found back of the fossa infundibuliformis.

The processus styloideus is an immediate continuation of the cartilage in the crus transversum incudis, as may be observed in the two months' fœtus, but at a little more advanced age they can be easily separated. The transition between the two parts takes place by a cartilaginous extension in the external and posterior part of the cartilage of the cavum tympani, wherein can be seen a fine, whitish transverse line between the crus transversum and the cartilage. The same is found at three months. In a fœtus of two and a half months the processus styloideus can be isolated to a length of five mm. When it leaves the cranium, it forms a right angle and runs like a chord over the lower third of the membrana tympani. At four months it still follows the same direction, and the chord over the membrana tympani has a length of six mm. In a five months' fœtus it consists of two pieces, united at a right angle. The upper, flat piece is situated inside the pars petrosa, and its cartilage is thin and light; the lower piece is longer, solid, dark, and ends downward in a point; it goes straight down by the outside of the meatus, has then a direction forward, inward and slightly upward, and forms like the membrana tympani an angle of thirty degrees with the horizontal plane of the cranium. The relation of the chord to the membrana tympani changes with further growth, so that at six and a half months it only runs by the lower fourth, and at seven and a half or eight months by the lower edge of the annulus membranæ tympani. This change corresponds with an entire turning of the pars petrosa, as will be explained later. Ossification of the processus styloideus has not been observed before birth.

Synchondrosis petroso basilaris. This connection between the anterior end of the pars petrosa and the pars basilaris with the sella turcica takes place by cartilage. While at early periods this transition cannot be observed, it is indicated at three months by a furrow in the upper surface, which becomes gradually deeper and at four months is covered with a fibrous tissue.

Processus petroso-basilaris and petroso-occipitalis. From the posterior part of the pars petrosa there ascends back of the superior semicircular canal an elongation of the cartilage, which in different mammalia has a large extension, and which Spöndli has named lamina parietalis. In man there is formed a small, flat, triangular mass of cartilage, which Hannover calls processus petroso parietalis. It is situated above the inside of the fonticulus casserii, the place where later the posterior and inferior angle of the ossa parietalia is formed, but it takes no part in the formation of this bone. It is comparatively larger in a small fœtus than in large ones, and its form often differs for the two sides of the cranium. It frequently sends out a cartilaginous elongation backward, of triangular form, the processus petroso-occipitalis, which is situated at the inside of the fissure between the upper and lower part of the pars squamosa occipitalis, to the ossification of which it probably contributes. At four months both processes have diminished in size, and at eight, they have entirely disappeared. Therefore, they belong to that part of the primordial cartilage which disappears before birth.

With the growth of the fœtus occurs a turning of the pars petrosa. It is known that the membrana tympani stands nearly horizontal in the fœtus, while in adults it approaches a vertical direction, but the same process of change of position occurs in every portion of the pars petrosa. In a fœtus, four months old, it can be distinctly observed that the edge of the pars petrosa, which in the adult is internal, is the upper one in the fœtus. This is of course not so distinct in the rounded part of the cartilage of the pars petrosa, but it is still recognizable in a division of the upper surface in two parts, an external part with the large hiatus canalis Fallopii, which in the adult lies in the upper part, and an internal part, in which is found the porus acusticus internus, which opens upward and inward, while in the adult it opens backward. The canalis semicircularis superior opens upward and inward from the fossa subarcuata, while in the adult it stands nearly perpendicular. The two other canals lie more hidden, but the canalis semicircularis externus lies in the fœtus lower than the inferior, and its point of ossification lies underneath that of the inferior semicircular canal. If we compare, therefore, the position of these parts in the fœtus and in the adult, we find that a turning around the longitudinal axis has apparently occurred, from the canalis semicircularis superior to the anterior end of the bone, so that its lower surface becomes the external, and the internal part of the upper surface its posterior wall. This turning takes place under an angle of about 45°, and is stronger forward than backward. It can be recognized in a fœtus of five and a half months in which the membrana tympani stands at an angle of 30°. This same angle exists still at five and a half months. But from that time, which corresponds with the sudden and extensive ossification, these changes of position become more distinct. At seven and a half months the membrana tympani forms an angle of 40°; the fenestra rotunda has drawn back from the median line of the body; the canalis semicircularis superior is directed more forward and inward, and the porus acusticus internus backward.

Ossicula auditus. At an early period the cavum tympani is filled with a gelatinous mass, which surrounds the thin ossicula auditus and can be hardly separated from them. Later these masses become more membranous, and allow an easier separation, but they fill the cavum tympani up to the time of birth. The walls of the cavity do not form all in the primordial cartilage. The outside wall is formed by the thick and opaque, later thinner membrana tympani, inclosed in the annulus; upward the cartilaginous wall is not complete. The posterior part of the tegmen tympani is formed in the primordial cartilage, which is derived from the cartilaginous seam at the outside of the pars petrosa, which becomes ossified and lies against the lower edge of the pars squamosa ossis temporalis, but the anterior part of the tegmen tympani, which also lies against the lower edge of the pars squamosa, is membranous and ossifies without cartilage. The inside wall is entirely cartilaginous.

From this inside wall originate the ossicula auditus, as a coherent, carti

laginous outgrowth. In a two months fœtus they are very thin, almost gelatinous, and incompletely formed, one coherent mass, without trace of separation. This mass stands in uninterrupted communication with the wall of the cavum tympani, at the place where, afterward, the oval window is formed, and the stapes cannot yet be regarded as a separate formation. In the fœtus under two months, the cartilage from which the incus and malleus originate, is situated so close to the internal wall of the cavum tympani that they can hardly be separated. Even in a fœtus of two and a half months the stapes is an uniform mass, which passes over immediately in the wall of the cavum tympani, and no oval window has formed. The cartilage is hyaline cartilage, with numerous very small cartilage-cells. At three months the form of the stapes becomes more distinct, and it can be drawn out from the fenestra ovalis, which has already formed, but at four months the plate of the stapes can still be incomplete, or it separates in two plates, so that in the effort to remove it, one plate remains in the fenestra ovalis. In a somewhat large four months' fœtus the fenestra ovalis and stapes-plate are completed, and from that time the original cohesion with the wall of the tympanum can no longer be demonstrated.

Also the incus and malleus form originally one mass. At two months there is an indication of separation, which at two and a half months appears like a perpendicular curved line. At three months the articulation between the cartilages becomes more distinct, and more so at four months, without there being any cavity between, yet, at five months, the cavity of the joint and all its projections are complete, and become stronger by ossification. At three months the cartilaginous ossicula auditus are only half as large as in the adult.

Ossification in the stapes occurs simultaneously with that in the pars petrosa, that is, at five months. The first ossification appears in the crura, about the place where the M. stapedius is attached. The process goes rapidly on and in a large five months' fœtus is found completed; only the ring, which is formed by the crura, is still open and cartilaginous in the capitulum, which remains cartilaginous up to six and a half or seven months. The surface of the plate which looks toward the oval window is covered with a layer of hyaline cartilage, probably a remnant of the original cartilaginous connection between the stapes and the internal wall of the cavum tympani. At seven and a half months the articulation between the stapes and os lenticulare was more distinct, the stapes ossified and in its permanent form.

The incus shows its permanent form sooner than either of the other ossicula auditus. At two months the crus descendens is still rudimentary, but at two and a half months the incus is well developed, and nearly half as large as in the adult. At first it is almost gelatinous, later thinner, but with normal form. The tip of the crus transversum is thicker than later, as it passes over immediately in the cartilage of the cavum tympani. This is best seen in a fœtus of two to three months. At four months the cartilage becomes

firmer, at five months it may be observed that the end has a reddish color, while the tympanic cartilage is more whitish, and both can be isolated. Ossification occurs at five months in the interior of the crus descendens, proceeds rapidly, and at seven months the tip of the crus transversum was ossified, showing distinct bone corpuscles at seven and a half months.

The malleus is in reality not found in the fœtus under two months. It is only represented by a semiglobular elevation, wherewith the processus Meckelii ends backward and lies against the incus; but neither manubrium nor collum are found. The semiglobular elevation forms later the capitulum mallei, but originally it belongs to the processus Meckelii. This capitulum originates with the incus in one piece. The first rudiment of a manubrium was found at two months, consisting of very small cartilage-cells, surrounded by pavement epithelium. The processus longus appeared as a tendinous chord beneath the processus Meckelii. At a little over two months the malleus was about 2 mm. long, and the processus longus ossified to a length of 1 mm. At three months the manubrium was completely formed, and its extremity united with the membrana tympani, while the processus longus was ossified to a length of 1.5 mm. The ossification in the malleus occurs one month before that in stapes, incus, or pars petrosa, and from this time the capitulum becomes more rounded and separated from the processus Meckelii, which at the same time diminishes in size. At five months the malleus had a length of 6.75 mm. and was ossified from the collum downward to the spot, where the processus longus, now 3.5 mm., ossified and inclosed in a strong sheath of connective tissue is attached, but the point of union of the bones is still separated by an intermediate cartilage. The ossification next extends higher up in the capitulum, at the side which is directed away from the joint, but as it is everywhere covered with a thin cartilage layer, it is possible that there now also occurs a calcification with the ossification, which also pertains in the first ossification in the incus, whereas the processus longus contains bone-corpuscles from the onset. At seven and a half or eight months the entire malleus, with the processus longus and brevis, are ossified, only the end of the manubrium in the membrana tympani is still cartilaginous.

The processus Meckelii consists in a two months' fœtus of hyaline cartilage with very numerous small cartilage-cells. It begins, as has been stated, in the capitulum mallei, or what later becomes the capitulum, goes forward, downward, and inward, partly straight, partly curved, is thickest nearest the capitulum, becomes gradually thinner, and inclosed in a sheath lays itself at the inside of the maxilla inferior, under the apertura posterior canalis alveolaris, and under the insertion of the maxilla mylo-hyoideus. It ends forward in a crook. It belongs to the part of the primordial cartilage, which afterward disappears, which begins at three and a half months. Kölliker considers the ligamentum laterale internum maxillæ inferioris as a remnant of the posterior end of the processus. A tabular statement is given of the length of the pro-

cessus in nineteen fœtuses, at ages from two to eight months, showing that up to the seventh month it increases in length, and after that time rapidly diminishes, and finally disappears, leaving only the capitulum mallei. But although the processus during this period increases in length, its crooked anterior end, hamulus processus Meckelii, begins to disappear as early as three and a half months, and the thickness also decreases.

The fourth chapter contains a comparison of the formation of the cranium with that of the vertebræ, and tends to prove one common process, with the pars basilaris ossis occipitalis playing the part of a hypothetical double vertebra.

Two plates containing the results of the examination of different fœtuses in the second chapter, and microscopical representations of calcification and real ossification are found at the end of the book, with explanations both in Danish and French text.

The work itself is a part of the eleventh volume of the Transactions of the Danish Royal Scientific Society, fifth series; section, natural history and mathematics.

J. J. B. Veymyne.

REVIEWS.

THE HISTORY OF MUSICAL PITCH. A. J. ELLIS: *Nature*, April 8, 1880.—This paper is an abridgment of a more extensive one upon the same subject, read before the Society of Arts, London, and contained in the journal of that Society for March 5 and April 2, 1880. After a few remarks on temperament, Mr. Ellis gives a simple rule for passing from A to C, and conversely. In equal temperament, A 444 vibrations corresponds to C 528. In mean-tone temperament, A 418 corresponds to C 500; while, for a perfect minor third between A and C, A 440 corresponds to C 528, and conversely.

The chief standards of pitch are tuning-forks and pipes, the former having been used since 1711. The pipe alters its pitch, roughly speaking, by one vibration in each 1,000 for each degree Fahrenheit, sharpening by heat and flattening by cold. Hence, in this paper the pitch is always reduced to 59° F. =15° C. The tuning-fork alters by one vibration in 21,000 per degree Fahrenheit, flattening by heat and sharpening by cold. The tuning-fork retains its pitch indefinitely if properly cared for, and even bad rusting causes a comparatively slight change. Mr. Ellis used in his various measurements the forks of a Scheibler's tonometer, the principle and mode of construction of which are explained in the paper.

In his investigations Mr. Ellis measured the pitch of a large number of old, original forks, and also that of many old organs. Besides this he made use of pipes from old organs now destroyed or altered, which had been kept by various builders, and he frequently had pipes reconstructed of the dimensions given in old treatises on music. Finally the researches of many other investigators were collected and their methods ascertained. Mr. Ellis has collected 320 different pitches, nearly half of which were first measured by himself. The earliest of these dates back to 1361.

Mention is made of the confusion existing with regard to the early Choir pitch and Chamber pitch, and some facts are given regarding the pitch of certain English organs, four different existing pitches, presenting a difference of five-eighths of a tone, being mentioned. Mr. Ellis describes his reconstruction of a pipe from measurements taken by Praetorius (1619) from the old Halberstadt organ, built in 1361, which pipe was found to give a very high pitch, five-fourths of a tone above the present highest orchestral pitch. Schlick, of Heidelberg, writing in 1511, justifies the use of this high pitch, and also the simultaneous use of a lower one, and actually recommends, at the same time and for the same purpose, the rendering of church music two pitches a

fourth apart. The lower of these two pitches, both of which were then in use, giving for A about 377 vibrations per second, was greatly developed in France, most old, untouched French organs still possessing it.

The high church pitch (A 474 vibrations, or thereabouts) was chiefly developed in Germany, and was also used in England before the Protectorate, as well as to a certain extent in France. The highest church pitch found was A 567, which was used in North Germany in 1619.

There were also two early chamber pitches, one high and the other low. The high chamber pitch was generally a great semitone, a mean tone, a mean minor third, or even a fourth flatter than the corresponding high church pitch. These chamber pitches came to be used in churches instead of the higher church pitches. It seems probable that most of the high church pitches were depressed on this account, from the very highest pitches known. These depressed church pitches were even further flattened, being still too high for instrumental chamber music. From these organ pitches a new chamber pitch was derived, which conflicted with that previously derived from the lower pitched organs. From this conflict, what Mr. Ellis terms "mean pitch" resulted. It was mentioned by Praetorius, in 1619, as the most suitable pitch for Protestant church music. A pipe reconstructed from his measurements, gave for C 507 vibrations, corresponding to A 424, the precise pitch used by the London Philharmonic Society, from its establishment in 1813 up to 1828. The extreme limits of this pitch noted by Mr. Ellis are A 415 and A 428 vibrations. The pitch of Handel's fork is A 422½, that of Stein, maker of pianos to Mozart, 421½, that of Von Weber, 423. This pitch prevailed over Europe, and must be considered as the classical pitch, as it was during its prevalence that most of the founders of modern music wrote. It is a semitone below the present orchestral pitch in England. This is perhaps the most important practical result reached by Mr. Ellis. The break-up of this mean pitch seems to have been purely accidental. A brief statement of some of the trivial circumstances which led to the change in different places is next given.

A table follows, giving a condensed history of musical pitch, which is appended to this abstract. The column T gives the number of *tenths* of an equal semitone, by which any pitch exceeds the initial zero pitch, so that by subtraction of their *tenths*, the interval between any two pitches in the table may be ascertained. The column marked A gives the nearest whole number of vibrations of A, in numerical order, from the lowest to the highest.

Condensed History of Musical Pitch.

1. *Church Pitch Lowest.*

T. A.

0....370....Zero pitch, not observed.

2....374....L'Hospice Comtesse, Lille.

3....377....Schlick, low, 1511; Bédos, 1766; French C foot organs; A. Silbermann at Strassburg, 1714.

2. *Church Pitch Low.*

10....392....Euler's clavichords, St. Petersburg, 1739.
11....395....Trinity College organ, 1759; English C foot organs; Roman pitch pipes, 1720.
12....396....Versailles Chapel, 1789; French B foot organs.

3. *Chamber Pitch Low.*

15....404....Roman pitch, 1730, from a fork.
16....407....Sauveur, Paris, 1713.
17....408....Mattheson, Hamburg, 1762.
17....409....Pascal Taskin, Paris, Court Clavecins, 1783.

4. *Mean Pitch for Two Centuries, English B foot Organs.*

20....415....Chained fork of the Roman Catholic Church organ, built by G. Silbermann, 1722.
21....418....Same organ in 1878. Euler's organs, 1781.
22....420....G. Silbermann's Freiberg organ, 1714; Torje Bosch's Seville Cathedral organ, 1785; and all church organs in Spain.
23....422....Stein's fork for Mozart's pianos, 1780; Lower resonance of Cremona violins, 1700; Old fork at Lille, about 1754; Verona and Padua, 1780; Russian Court church band, 1860.
23....423....Handel's fork, 1751; Green's St. Katharine's, 1778, and Kew, 1790; Dresden Opera under Weber, 1815–21; Paris Comic Opera, 1820.
24....424....Praetorius's "suitable" church pitch, 1619; Original Philharmonic Concerts, 1813–1828.
25....427....Paris Grand Opera, 1811.
25....428....Renatus Harris's organs, 1696; Green's St. George's, Windsor Castle, 1788; Paris Comic Opera, 1823.

5. *The Compromise Pitch.*

27....433....Sir George Smart's fork, 1828.
27....434....Paris Grand Opera, 1829.
28....435....French Diapason Normal, 1859.

6. *Modern Orchestral and *Ancient Medium Pitch.*

30....440....Paris Conservatoire, 1812; Paris Opera, 1829; Scheibler's Stuttgart pitch, 1834; Dresden, 1862.
31....442....*Father Smith's (= Bernard Schmidt's) low pitch at Hampton Court Palace, 1690; English B flat foot organs.
31....443....Bologna, Liceo Musicale, 1869.
32....445....Madrid, Opera, 1858; Naples, S. Carlo, 1857.

32... 446....Broadwood's medium. 1849–80: Paris. Grand Opera, 1856: Griesbach's A 445.7, 1860, for Society of Arts. meant for A 444.

33....447....Vienna Opera, 1878.

34....449....Paris Grand Opera, 1858: Leipzig. Gewandhaus Concerts, 1859; Griesbach's C 534.5, 1860, for Society of Arts, meant for C 528.

35....451....Lille Opera, 1848 and 1854: British and Belgian Military Instruments Standards, 1879; Higher resonance of Cremona violins about 1700.

35....453....Mean of the Philharmonic Concerts under Sir M. Costa, 1846–54.

36....455....Highest Philharmonic, 1874; Broadwood's, Erard's, Brinsmead's, and (English) Steinway's concert pianos, 1880.

36....456....Vienna celebrated high pitch before 1859.

37....457....(American) Steinway's pianos.

7. *Church Pitch High.*

37....458....Vienna, large Franciscan organ, 1640.

43....474 ...Tompkin's Standard, 1668; Father Smith's high pitch at old Durham and old St. James's Chapel Royal Organs, 1683 and 1708; the Jordan's, at St. George's, Botolph Lane, 1748; English A foot organs.

45....481....St. Catherine's, Hamburg, 1543.

46....484....Old smaller organ in Cathedral, Lübeck.

48....489....St. James's (S. Jacobi), Hamburg, original pitch, 1688.

8. *Church Pitch Highest.*

50....494....St. James's (S. Jacobi), Hamburg, present pitch, 1879.

51....496....Rendsburg organ, 1668.

53 ...504....Schlick's high pitch, 1511: Mersenne's *ton de chapelle*, 1636.

54....506....Halberstadt organ, 1361.

9. *Church Pitch Extreme and Chamber Pitch Highest.*

73....563....Mersenne, *ton de chambre*, 1636.

74....567....Usual church pitch in North Germany in 1619, called chamber pitch by Praetorius. Probable pitch of church music of Orlando Gibbons (1583–1625). C. R. Cross.

The State of the Soft Palate During Articulation, and a Means of Diagnosis in Paresis of the Same (Ueber das Verhalten des Gaumensegels bei der Articulation und über die Diagnose der Gaumensegelsparese). By Dr. Arthur Hartmann, of Berlin. *Centralblatt f. d. Med. Wiss.*, No. 15, 1880. —In the author's description of his experiments upon the permeability of the

Eustachian tube during phonation, he drew attention to the fact that he could also show that there exists a closure of the soft palate, *i.e.*, a shutting off of the naso-pharynx from the lower part of the pharynx during the formation of vowels.

His method of examination he has simplified, by substituting the ordinary india-rubber bag used by the aurist, for the more cumbersome compression pump. The two nostril-openings of the person examined are to be stopped by means of a double, olive-shaped nose-piece. With one of these "olives" there is connected, by means of a rubber-tube, a manometer containing water or mercury, and with the other a rubber inflation-bag. If now the inflation-bag be squeezed, while the velum palati is at rest, the air conveyed to the nostril by one of the "olives" flows into the lower part of the pharynx, but if the bag is compressed during the utterance of a vowel, the air does not escape in the same manner but is dammed up in the common naso-pharyngeal space, and this damming back will show itself on the manometer in connection with the second olive-shaped nose-piece. In all the experiments made with this apparatus it was found that with all the vowels there is always a complete closure of the velum palati, excepting with *a*. With *a* it may be absent, as in the author himself, who is able to make this sound either with or without complete closure of the velum. Even when only a slight pressure, for example only when twenty mm. of the water column is exerted in the nostrils, the elevation of the manometric column remains the same so long as phonation persists, with slight alterations. The results lately obtained by Pienaczek, by rhinoscopic examination, viz.: that the velum in vowel formation never touches the pharyngeal wall, and also the similar results arrived at by Voltolini, are not to be considered as conforming with the normal relations of the parts in question, because the mere introduction of a pharyngeal mirror during phonation must necessarily alter the position of the pharyngeal organs.

The author further endeavored to determine the firmness of the closure of the velum, by increasing the pressure in the nostril until the resistance of the velum was overcome. This could be detected by a loud, gurgling râle, produced by the passing of the air down into the lower part of the pharynx, also by the sensations of the patient as well by the sinking in the manometric column. In seven cases in which it was possible to assume that the relations of the velum were normal, it was necessary to use pressures from thirty to one hundred mm. of the mercury column, in order to overcome the resistance of the velum palati during formation of vowel sounds. The results obtained for the various vowels in the individuals experimented on were found to be about the same. Thus, in the case of Dr. U., variations between forty and fifty mm. Hg. were found, and in the author's case variations between eighty and one hundred mm.

About the same resistance that it forms with vowels, the velum also forms with consonants *w*, *r*, and *l*. With sharp *s* and *sch*, a somewhat stronger pressure is necessary, and the strongest resistance is offered by the velum in the for-

mation of *k*, especially when the position of the closure is placed far behind. In such cases a pressure of 200 mm. Hg. is attained.

In those affected by chronic pharyngeal catarrh, deafness, and tinnitus aurium, in whom also it is possible to see a flaccid action of the velum palati, only slight pressures are necessary, from ten to twenty mm. Hg., in order to overcome the resistance of the velum palati.

The author, therefore, concludes very justly that his method of examination can be utilized in diagnosis, and will enable us to determine whether the function of the velum is impaired or not. In one of his patients, suffering from paralysis of the velum, as a sequel of diphtheria, the air streamed into the lower part of the pharynx in uttering all the vocal sounds excepting *k*, at which time a slight resistance of about thirty mm. Hg. was offered.

The Treatment of Aural Polyps (Zur Behandlung der Ohrpolypen). By Prof. Adam Politzer, of Vienna. *Wiener Med. Wochenschr.*, No. 31, 1880.—The following statements form the completion of an article on the treatment of aural polyps, which appeared a year ago in the same periodical, No. 16, and was continued through other numbers. The author there drew attention to the fact that operative treatment of intra-tympanal polypi, which spring from the upper wall of the tympanic cavity or from the mastoid antrum, rarely has a favorable result, because the root of the neoplasm cannot be reached with an instrument. Even after repeated removal of those parts of the polyp, which can be grasped by the instrument, the remnant scarcely undergoes any contraction, but, on the contrary, the new growth appears again sooner or later, and the removal of it from time to time is only a removal of a mechanical obstruction to the flow of pus from deeper parts. The endeavors to destroy granulations and polypi, in the external and middle ear, by means of drops of concentrated solutions of acetate of lead, muriate of iron, and sulphate of copper, or by penciling with opium and tincture of iodine, are in most cases useless. In fact it is very often observed that after a prolonged use of the substances named, the growth of the polypus is more rapid, because the firm, insoluble precipitates formed between the mineral salts and the pus, irritate the swollen mucous membrane and the hypertrophied cutis. Besides, as experience shows, the accumulation of such precipitates behind polypous growths, very often causes severe inflammation, which may implicate the bony wall of the middle ear and thence the cranial cavity.

Nitrate of silver in substance, solution of muriate of iron, pulverized sulphate of copper, a paste of chloride of zinc and chromic acid act well if placed skilfully on the root and nowhere else, but this demands an expertness which comes only to the specialist by long experience in manipulation, and hence practically excludes these remedies from the use of the general practitioner. In fact even these remedies are of little value to the specialist if the

perforation in the drum-head and the position of the root of the polyp do not permit an easy application of the caustic. In those cases where the swelling and infiltration of the membrana tympani, or where adhesions between it and the inner tympanic wall, prevent reaching easily the walls of the drum-cavity, the most careful manipulation will not effect a proper application of the caustic.

Better than any of the caustics named is the galvano-cautery for destroying granulations and polypi, for by it the new growth is radically destroyed, the root rapidly contracts, and there is rarely any inflammatory reaction. But this method can never be widely used in general practice, because it demands a complicated instrument and great skill in the use of the cautery, which latter can only come about by long practice. It is therefore of all the greater value to the general practitioner to possess a means which can be used simply and efficaciously in a large number of cases of granulations and polypoid growths, without any risk of injury to healthy parts. This the author thinks is supplied in *rectified spirits of wine.*

In cases of chronic purulent inflammation in the ear, when this remedy is to be employed, the first step should be a thorough cleansing out of the tympanum by means of Politzer's air-douche, and then the external ear should be syringed with warm water. All fluid should then be dried out of the ear by means of absorbent cotton. Then with the head on one side, the affected ear being uppermost, the external ear should be filled with lukewarm alcohol, which should be allowed to remain in the ear at least from ten to fifteen minutes. In most cases this application produces only a feeling of warmth, though sometimes it produces a burning or pain. The latter, however, is usually of short duration and is not felt after the first few days of treatment. If the pain is intense it is best to dilute the alcohol with an equal quantity of water, preferably with distilled water. The instillations should take place three times daily at first, though later, when the growths in the ear begin to shrink, the applications may be made only twice and finally once daily.

Immediately after the use of the alcohol the formerly deep red granulations and polypi are seen to be a pale grayish red in color, due to the coagulation of the mucus and albumen on their surface.

If the alcohol is allowed to remain longer in contact with the new growth, it penetrates into the superficial layers of the polypus and coagulates the contents of the blood-vessels and induces a shrinking of its tissues. This action on the part of the alcohol is not entirely independent of the structure of the polypus, since the soft, round-cell polypi are more easily destroyed by it than the tough fibromata: although even the latter disappear entirely under a continued use of alcohol-instillations.

In one case, a man, forty-six years old, who for eight months had suffered from otorrhœa, a smooth, fibrous polyp was found extending to the opening of the auditory canal, and which on examination with a probe was found to

be attached to the wall of the canal near the membrana tympani. The attachment of the polypus was so firm and deep that it was deemed unadvisable to extract it with Wilde's snare. Therefore it was determined to take away only the mass of the polypus by the snare, and a piece as large as a pea was left attached to the canal. The piecemeal destruction of the remnant by tearing and cauterization, which had been intended, could not be carried out, because the patient was obliged to leave the city. In the meantime he was ordered to use instillations of alcohol. Several months later, when the patient presented himself once more for examination, no trace of the polypus was found, the lining of the auditory canal and the membrana tympani appeared normal and the hearing was perfect. No relapse had occurred in one and a half year. And in the author's experience, in a number of instances, equally good results were obtained by alcohol, where in spite of frequent operations, and cauterizations, the granulations and polypi would not disappear.

Several other cases are given in which the use of alcohol seemed to produce highly satisfactory results.

A strikingly good result is obtained with alcohol in cases of diffuse hypertrophy of the mucous membrane in the middle ear, when it assumes the form of spongy granulations, extending freely through the perforation in the membrana tympani. Such cases usually are characterized by a specially stubborn course, defying all remedies. In these Prof. Politzer says he has observed a diminution of the swelling in the mucous membrane to occur after cleansing the middle ear by syringing through the Eustachian tube with the aid of the catheter, and then the use of alcohol.

In cases of granulations and polypoid growths on the drum-membrane, alcohol instillations do good service. But here the duration of the treatment is variable.

In the case of a young man who had had an otorrhœa for six months, and in whose ear a small lobulated polypus the size of a small pea was found and removed, the root shrivelled after two applications of alcohol, and the drum-membrane became dry, and the hearing nearly normal. Though in many cases the disappearance of the root under the alcohol treatment occurs rapidly, it must be stated that, in the majority of cases, the alcohol treatment has to be pursued for weeks and months uninterruptedly in order to destroy the new growth. Its use should not be abandoned, until, after using it several weeks, no signs of diminution in the morbid growth appear.

Rectified spirits of wine has proven itself an admirable means in more than half the cases in which it was used to destroy remnants of polypi and granulations, and in some cases it rendered operations unnecessary. Its advantages are, that it is incomparably surer than caustics already named; that it forms no insoluble precipitates with the secretions, and that it has no attendant bad effects on neighboring tissues. The alcohol treatment—and this is one of its great advantages—can be used by every practitioner of medicine. It is of im-

portance, therefore, that our confrères should give publicity to their experiences with it.

The conclusions are as follows:

"The indications of the employment of alcohol in polypoid growths in the organ of hearing are—

"1. To destroy the remnants of polypi in the external auditory canal, on the membrana tympani, but especially in the tympanic cavity, where they are beyond the reach of instruments.

"2. In multiple granulations and polypi in the external auditory canal, and on the membrana tympani.

"3. In diffuse and excessive hypertrophy of the mucous membrane of the middle ear.

"4. In cases where, in consequence of mechanical hinderances in the external auditory canal, the removal of the polyp cannot be accomplished with instruments.

"5. It may be used experimentally as a substitute, at the outset at least, for instrumental treatment in timid adults and children, in whom an operation is often attended with difficulties, and is only accomplished under anæsthesia."

An aural case of peculiar interest was reported by Dr. Todd to the St. Louis Medico-Chirurgical Society—*St. Louis Courier of Medicine*, July, 1880. The case was that of a man who had been for four years greatly annoyed by a crackling sound in the right ear, every time he moved his head. This noise came on gradually after a bad cold. Incidentally, it was stated that when quite young there was a large suture between the parietal and temporal bones; a depression there when he was two years of age required the parents to be cautious about any one touching him on the head. The reporter observed a contraction of the sterno-cleido-mastoid muscle, and coincidently heard a noise quite distinctly at the distance of a foot from the patient—at times it could be heard many feet off. By the aid of a stethoscope placed over the mastoid process, the noise was distinctly heard. It was also heard at the anterior nares. With the contraction of the sterno-cleido-mastoid there was also spasmodic action of the velum palati. The patient is described as being nervous and hypochondriacal. He said he never had any pain in the place, but the noise drove him crazy—he was really desperate, and willing to submit to anything that promised to afford relief. After careful examination Dr. Todd decided that no operation would be likely to afford the patient any relief.

Dr. H. N. Spencer presented to the Society at its next meeting a patient who had, about a year and a half previously, received a gunshot wound of the head, the case offering some points of unusual interest. The ball entered the head on the right side, at a point three-quarters of an inch below the floor of the external auditory meatus, and seven-eighths of an inch in front, and passed

out on the opposite side of the head. At the time of the injury hearing was unaffected, but in a few days he experienced a noise which has continued ever since. This noise can be heard by means of the diagnostic tube—it is a continuous bruit.

Subsequent to the injury, coming on gradually for two months, the patient experienced great deafness in both ears, which Dr. Spencer thinks was caused by an otitis media, produced by the great exposure to cold which was experienced at the time of the injury. The patient was unconscious after he was shot—he received eight gunshot wounds in different parts of the body on the same occasion. No arterial hemorrhage from the wound in the head was observed, and there was no vertigo or vomiting.

The Use of Sulphide of Calcium in inflammatory and suppurative processes about the ear and throat, was also discussed at the same meeting of the Medico-Chirurgical Society. Dr. Todd had administered this medicine in the case of a child about eleven years old, who was suffering intense pain from suppuration of one of the ears. There was also a great deal of swelling about the ear, and some of the neighboring glands. From doses of one-twentieth of a grain, given every two hours, the pain was relieved in a most marked manner. Dr. Spencer, in referring to the use of this drug, stated that in his experience, after giving it a fair trial in some forty-five cases of furuncular inflammation together with suppurative process in the middle ear, he could not see that it had in any instance either shortened a case or influenced it in any way.

Dr. Glasgow reported having treated successfully several suppurative cases successfully; one of them, a case of tonsillitis, where the pain was intense, was greatly benefited by the use of one-quarter of a grain every two hours. Others, however, who reported their experience to the society had failed to obtain results similar to those of Dr. Glasgow. What preparation of the remedy was employed by the gentlemen who related their experience was not stated, although some doubt was expressed as to the drug's purity in all of the cases where it was used.

When so much discrepancy exists, as regards the results obtained from the use of this drug by careful observers, it may be supposed that the article used was not always reliable, or that individuals differ respecting the symptoms that require its administration.

Mr. Field—*Lancet*, June 5, 1880—reports a case of suppurative meningitis and abscess of the brain, which came to St. Mary's Hospital for treatment. The patient was a male, aged eighteen, and walked to the hospital. When admitted he had had a purulent discharge from the right ear for sixteen years, following scarlet fever. The only symptom was pain in the head, which was immediately relieved by the application of eight leeches around the right ear. Iodide of potassium mixture was prescribed, and the ear was ordered to be

syringed four times a day with a weak carbolic acid lotion. The patient died very suddenly three days after his admission. The post-mortem examination showed that there had been suppurative meningitis over the petrous portion of the right temporal bone, in the posterior fossa of the skull, above the tentorium cerebelli, and also to a slight extent in the cerebellar fossa. Over the outer part of the petrous bone, beneath the dura mater, was a layer of pus, and the dura itself was in a sloughy condition over a surface the size of a horse-bean. The inner surface of the mastoid bone, where it enters into the formation of the lateral sinus, was of a blackish gray color, and the bone here was so soft as readily to allow a penetration. For the same extent the sinus itself was occupied by a very firm thrombus, partly black and partly of a yellowish brown color. The internal auditory meatus was healthy. A thick layer of puriform lymph was found on the under surface of the posterior half of the right temporal sphenoidal lobe of the brain, and also on the inner surface of the occipital lobe. An abscess, the size of a large walnut, with dirty gray, sloughy, and purulent contents in the right hemisphere of the cerebellum, external to the corpus dentatum. The brain substance generally and its membranes were congested. The ventricular fluid was slightly in excess and clear. The tympanic membrane was absent, and there was some pus in the external auditory meatus; the drum was filled by a yellow caseous matter, which blocked the Eustachian tube. The malleus was found loose in the cavity, its head carious, but the incus and stapes were both absent. The chorda tympani nerve could only be traced for a short distance after entering the tympanum.

The vestibule was occupied by soft caseous matter, shown by the microscope to consist of fat granules, and shrunken and flattened epitheloid cells. The cochlea, semicircular canals, aqueduct of Fallopius, and carotid canal were healthy, and the facial nerve appeared to be uninjured. The site of the natural petrous and mastoid cells was occupied by an irregular cavity, which contained blackish gray, purulent matter, and around this the bone was softened and reddened for some distance, evidently from progressive caries. This careful examination was made by Mr. A. J. Pepper. Mr. Field, in remarking on this case, took occasion to allude somewhat in detail to the subject of abscess of the brain. The interest this matter possesses to otologists seems to be a sufficient reason for drawing most liberally on his able résumé of the subject. Mr. Field alluded to the great uncertainty of the diagnosis of abscess of the brain, the above case being a good example of the sudden manner in which it is frequently revealed. Clinically, it appears under many aspects; its causes are various, and the symptoms it gives rise to vary with the cause.

It seems to be now well established by pathologists that abscess of the brain is never a primary affection, and we should therefore, in all cases where death has occurred from this cause, endeavor to obtain evidence of past or present suppuration in some other portion of the body (and it may be in any part), in order to clear up the diagnosis. The abscess of the brain may pre-

sent itself in various stages, as either a patch of red-colored acute softening, which has not got broken down to form an abscess; as a ragged cavity, with gray, soft, and irregular walls, containing pus, which may be more or less discolored, the change in either case being an acute one; or, finally, it may appear as a well-defined cavity, with tough and fibrous walls, which contains a green-colored, opaque fluid, resembling pus, but which, on examination, may be found to contain no pus-cells, they all having undergone fatty and granular degeneration. It may also contain cretaceous material. Abscesses of the brain are usually single, and their location is most commonly in the posterior part of the brain. The motor tract thus escaping, paralysis is therefore but rarely associated with them. They affect the white matter rather than the gray, most frequently that of the posterior part of the middle lobe, or the posterior lobe of the cerebellum. Occasionally, however, they occur in the corpus striatum or pons.

The more acute forms of abscess give rise to the signs usually attributed to meningitis or encephalitis, while the more chronic ones give rise to no symptoms whatever until the abscess extends sufficiently near the surface of the brain to light up an inflammation of the membranes, this being the usual mode of termination. Mr. Field doubts not that in numerous instances, if one may rely on the clinical history of recorded cases, the condition had existed for months, or even years, before death, without giving rise to a single indication of cerebral disease. Abscesses in occasional instances are found in the brain after death, having never been the cause, during life, of any cerebral symptoms, and would probably never have done so had life been prolonged for an indefinite period. It is probable, from appearances that have been found, that recoveries from such abscesses has taken place; the pus, undergoing fatty degeneration, becomes quiescent, the fat is reabsorbed, and the fibroid sac shrinks and gradually contracts upon a cretaceous residue. On the other hand, cerebral abscesses have been known to penetrate the skull and open externally, forming a hernia cerebri. Disease of the middle or internal ear, producing necrosis of the temporal bone, is by far the most common cause of abscess of the brain, accounting for, it is said, about one-third of the cases. There are two chief types under which it occurs, varying with the circumstances. In one extensive disease of the bone exists, purulent matter being present beneath the dura mater, and frequently thrombosis of one or more of the venous sinuses in connection with the petrous bone is present. The dura mater itself becomes thickened, the arachnoid and pia mater adherent over it. The brain tissue in the immediate neighborhood is more or less inflamed and softened, and the abscess is near the surface. It is commonly found associated with a general meningitis. The symptoms during life are those of meningitis or encephalitis, and their duration is usually not less than ten days, frequently some weeks. The case described above belongs to this group, and, considering the character of the lesions, the duration of severe

symptoms was remarkably short. The cause in such cases is evident, either in the extension of the inflammation by contiguity of structure, or in thrombosis of the veins passing backward into the cerebral substance. In the other type of abscess from ear disease, the relations of the two conditions is more obscure; here is, perhaps, very slight necrosis of the petrous bone, which is found with difficulty, no adhesions of membranes, and perfectly healthy cerebral tissue intervening between the abscess and the surface of the brain. The veins, moreover, are not thrombosed.

These abscesses are, without doubt, secondary to disease of the petrous bone; but we have at present no evidence to show how the materies morbi is conveyed from one place to another, although the assumption is that some infective material is conveyed either by lymphatics, arteries, or veins. The shortness of the distance makes it difficult to trace the connection between these conditions. When the abscess is secondary to some collection of pus in more remote parts of the body, such as an empyema, an ischio-rectal abscess, or one in the shaft of a long bone, the difficulty in establishing a connection is increased.

The brain, unlike all other organs, is liable to the deposition of these secondary abscesses, without any signs of a general pyæmia. These, of course, cannot be strictly compared to the secondary abscess occurring in the liver, for in this case the peculiar blood-supply affords a ready explanation. These abscesses are much more chronic in their nature than those previously described. It is these which often give no signs during life; if rather more acute, they may terminate by exciting a meningitis when they approach the surface, which is always suppurative and very severe. Although this form of abscess may remain quiet for months, death rapidly follows the first symptoms that manifest themselves.

Abscesses of the brain, resulting from disease or injury of the nose, eyes, skull, scalp, or face, or from operations upon these parts, have the same pathological and clinical history, or one intermediate between them, as these two types. Injuries to the head may give rise to abscesses connected with the dura mater, the symptoms of which it is often impossible to distinguish clinically from those described; or abscesses similar to those described may arise. It should be remembered, under all these circumstances, cerebral symptoms may arise which would seem to indicate the existence of abscess or meningitis, but that these symptoms occasionally clear up and the patient makes a good recovery. In all of these cases our prognosis should, therefore, be most guarded.

Abscesses that result occasionally from general pyæmia are usually multiple and small. When they result from embolism of one of the cerebral arteries, they are usually associated with sudden paralysis and the usual symptoms of embolism. Red softening is more frequently found associated with these symptoms. Occasionally this has broken down and formed an abscess, or rather the softening has been so defined that it almost justified the name of abscess.

Three Cases of Cerebral Abscess consequent upon Suppurative Disease of the Middle Ear, with Remarks. Thomas Barr. *The Glasgow Med. Journal,* July, 1880.—Now that attention is called with greater frequency than heretofore to the extension of suppurative disease of the middle ear to the brain, or its enveloping membranes, the importance of early attention to aural affections is more generally recognized. Doubtless this source of fatal cerebral disease is as yet overlooked in a large number of instances; in fact, every physician whose opportunities of observing such cases in aural practice is extensive must soon become convinced of this fact. It is to be hoped, however, that with the increasing interest that is everywhere being manifested in the field of Otology fewer cases of this kind will occur in the future without recognition. Although otitis media purulenta is, in the greater number of cases, a disease of chronicity and difficult of management, yet when the numerous factors that exercise an unfavorable influence on its progress are more fully understood, and its local treatment is in consequence less obtrusive, we shall have more cures and fewer fatal terminations. The profession at large will not be slow to recognize the advantages of a special training in this department of medicine when otology shall no longer bear the opprobrium hitherto associated with the ineffectual methods of an almost exclusively local treatment.

Dr. Barr's cases do not materially differ from those with which we are already familiar, but they are presented in a manner to forcibly impress the reader, and fortunately he has been able to have a *post-mortem* examination made in each case. Incidentally Dr. Barr alludes to the fact that in *post-mortem* examinations the organ of hearing has generally been overlooked in consequence of the difficulty of opening the middle ear; he suggests that the method adopted by Dr. Foulis, in making a section of the ear after death, could be adopted as a matter of routine, as it can be expeditiously done without the removal of the temporal bone from the skull, and it allows of a very fair view of its condition. Were these examinations of the ear more frequently made in cases where disease of the ear was not suspected, it would add very materially to our knowledge of the pathology of this organ. Referring to ear affections as a cause of abscess of the brain, the conclusion is drawn from the literature of the subject that aural affections in at least one-half of the cases act as an exciting cause.

In Dr. Barr's cases the condition of the parts found after death indicated that in one case only were there carious openings between the pus-secreting cavities of the middle ear and the dura mater. Caries would naturally be looked for in these cases at the roof of the middle ear and the inner wall of the mastoid process, and in the second case reported carious openings existed in these two situations. It is now well known, from numerous observations on the dead body, that suppurative diseases of the ear may bring about a fatal issue, without a carious affection. The disease may be conducted to the dura mater by the numerous foramina in the bone, for the passage of vessels, nerves,

and connective tissue; or, if by destruction of the two fenestral membranes, the vestibule and cochlea are invaded by the disease, there would then lie, between the seat of the inflammation and the meninges, only the perforated lamella of bone through which the fibres of the auditory nerve pass. In all three cases the dura mater was thickened and softened, over the tegmen tympani in the first case, over the carious openings in the second, and over the inner surface of the mastoid process in the third. Part of the blood supplied to the middle ear being derived from within the cranium, the accompanying veins which carry away the effete matters from the ear pass partly inward through the bone to the dura mater. The walls of these vessels having become diseased may set up inflammation in the dura mater, or excite phlebitis in the sinuses, with the attendant danger of the formation of thrombi and purulent dispositions in the other organs; bacteria may possibly be introduced into the blood-vessels along with purulent matter, the consequences of which might be disastrous. The inflammatory condition, it is thought, passes from the dura to the brain by contiguity of tissue, as there is no direct vascular or lymphatic connection between the dura mater and the substance of the brain. Dr. Barr's paper was read before the Glasgow Medico-Chirurgical Society, and was the subject of an animated discussion, several gentlemen present having had considerable experience in the matter under consideration. Dr. Coats being present remarked that he had speculated in regard to what might be the path of injection in such cases, and he suggested that it was probably by way of the lymphatics. By this path the injective material might enter the arachnoid cavity, and travel inward to the spaces inside the brain. He had himself seen several cases in which this had been the path followed. The abscess might be disassociated from its place of origin by a considerable portion of tissue.

Periscope of Otology. Dr. Kirk Duncanson.—In this communication Dr. Duncanson presents a tabulated report of the aural cases treated at the Dispensary, Cambridge St. Lothian Road, Edinburgh, during two years from July, 1878, to June, 1880. The number of cases treated in all amounted to 816 within the periods mentioned. Of the diseases of the external ear, the accumulation of cerumen (ceruminosis obturans) bears a large proportion, 208 cases in all, while the cases of epithelial masses (keratosis obturans), ten, are comparatively few in number.

Of the diseases of the middle ear the most numerous are those of chronic suppurative inflammation, 210, next in order coming chronic catarrhal inflammation, 208. Of the sixteen cases of disease of the inner ear two are recorded as labyrinthine disease from congenital syphilis.

Appended to the report is a table giving the ages of the patients, which shows that of the whole number, 396, over forty-eight per cent. were between the ages of ten and thirty years. Under ten years of age there were 122 cases, and between the ages of seventy-one and eighty years but ten cases.

Deafness (Surdité). Dr. Ladreit de Lacharrière: *Annales des Maladies de l'Oreille*, etc. Pp. 38. Paris. February, 1880.—In this article the writer gives a running commentary on the most common forms of aural disease, as met in an ordinary practice in otology. It opens with a few reflections upon the gravity of the affliction of deafness, and calls attention to the fact that very often a "wise hygiene might often prevent the occurrence of this infirmity, which too often science is unable to remove."

He further urges the necessity of the parent's insisting on the child's talking, if it has lost its hearing after it has once mastered speech. Deafness, even in one ear, he considers as entirely unfitting a man for being a soldier, because when deaf in one ear he is no longer able to determine the direction of sound.

So far as tests for hearing are concerned, Lacharrière gives preference, as do most aurists in the present day, to the human voice, and he thinks that the physician can accustom himself to speaking always in a similar tone when making his tests. He very justly says the watch, which is not a good test, has come into use, simply because it is always with the patient and the doctor, and hence easily brought into use. The great reason why the watch should not be deemed a good test, is, that "there is never a constant relation between the hearing a watch and the audition of words."

He then alludes to several well-known acoumeters, Guerder's, Itard's, De Ceuta's, Magnus', Politzer's, Kessel's, and to the Blake-tests with König's rods. So far as the microphone is concerned as a test for hearing, the writer is disposed to think that though the method is ingenious it belongs rather to the laboratory of the physicist than to the office of an aurist. It is essential, in examining into the causes of deafness, to find out whether the obstacle resides exclusively in the conducting or in the perceptive apparatus. The writer then gives two rules quoted from Capdeville which are here given, but each must verify them for himself:

1. Whenever a watch is heard better on the skull than it is thirty centimetres off, and *a fortiori*, still farther away, we are dealing with a case of disease of the conductors of sound.

2. Whenever the watch is heard as poorly on the head as thirty centimetres off, or when not heard at either of these points, we are dealing with a case of disease in deeper parts, *i.e.*, the internal ear, the auditory nerve, or the nerve centres.

Hearing better in a noise than in a quiet place is considered by the writer to indicate usually ankylosis of the chain of bonelets. When deafness is not absolute it seems that sometimes its degree varies with atmospheric changes, but the changes affecting some deaf people do not affect others, one set being made worse by cold, dry winds, and others by damp air, and storms, while others are quite free from annoyance in rainy and warm weather. In explanation, the writer offers "that it has seemed to him that deafness caused by

catarrhal diseases is worse in damp weather; that that which attends congestive affections, as those caused by herpetic disease, or those forms of deafness found in individuals suffering from diseases of the vasomotor system, vary in intensity according to the magnetic conditions of the atmosphere." Allusion is then made to the well-known observation, that deaf women at the catamenial period are very likely to be harder of hearing, if their ears are affected at all. The writer mentions the peculiar phenomenon, sometimes observed in the deaf, that suddenly their deafness leaves them for a moment or two, when they hear perfectly well, but this is succeeded by profound deafness. No explanation is offered for this, but the author is convinced that such cases do occur, and that they are not illusions on the part of the patients.

Deafness is sometimes the precursor of cerebral diseases, especially of tubercular meningitis. The author believes that if the expansion of the auditory nerve were as easily visible as the retina, it would not be difficult to determine diseased processes analogous to those in the retina. He gives a case which he observed in 1877; a lad, nine years old, and very intelligent, a student in the Lyceum of Paris, who had become deaf within a few months, so that he could no longer go on with his studies. The middle ear was not affected, but the tinnitus aurium ("bruits labyrinthiques") pointed to a deeper disease. All efforts for relief of deafness were fruitless, and the cophosis became more profound. The parents were informed that their child showed symptoms of grave disease, and the boy died shortly of tubercular meningitis. A case is quoted from Dr. Luys, of a woman who had been deaf for twenty years, and in whom the posterior convolutions of the brain were the seat of an atrophy. In some places the atrophy had produced spaces large enough to receive the end of the thumb. The possible or probable cause was not determined for the disease in this case. Syphilis is set down as the cause of deafness, from disease produced by it in the intracranial organs.

Retrocession of exanthemata, continued fevers, meningitis and convulsions in children, are all recognized as causes of deafness. Excessive fright has apparently provoked, in one case given by the writer, profound deafness, which supervened upon the convulsions into which the little boy was thrown.

Convulsions arising from disorders in the digestive tract may produce similar results. The list of nervous diseases which may affect the hearing closes with hysteria and its effect on the hearing. "The ear," the writer says, "pays its tribute to the bizarre manifestations of this neurosis." The character of hysterical deafness is suddenness of onset. Sometimes the deafness accompanies other nervous manifestations, and at other times it is the only morbid symptom. The ears preserve an appearance of perfect health, and the patients complain of only one symptom, viz.: they cannot hear. It is also stated that such cases are never half-deaf, but they can hear absolutely nothing. An account is given of a young lady, the daughter of a prominent func-

tionary of the time, who had suddenly lost all hearing without any apparent cause. A diagnosis of hysterical paralysis of the auditory nerve was made, and the patient was advised by Dr. Lacharrière to place herself under treatment in a hydropathic institution, which she did, and in a few weeks later her father reported her as entirely cured. Hysterical deafness must not be confounded with deafness in hysterical subjects, for in the latter the deafness may be due to a cause entirely different from the nervous malady, though it may borrow a nervous phase from it. Local causes of deafness may reside in the auditory canal, the Eustachian tube, the membrane of the drum, the drum-cavity, and the organs contained in it, and, finally, the labyrinth and the osseous structures containing it.

It would seem superfluous to call attention to the deafness producible by cerumen plugs in the external ear, but the writer has seen so many failures to diagnose the obstruction that he calls the attention of the profession to the importance of careful examinations of the external ear, especially the deeper parts of the auditory canal.

In alluding to closure of the Eustachian tube from disease, it is asserted that as we hear our own voices directly through these tubes, if they are closed our own voices are of course changed to our ears. Thus, of course, the changed tones of the deaf might be accounted for. The noises in the ear, heard in inflammation of the tympanic cavity, are said to be due to the compression of the fenestræ, and, mediately, of the fluid in the labyrinth, a theory not held by the majority of aurists of the present day, because pressure on the fluid of the labyrinth would produce rather a blunting of sensibility than an augmentation. The only theory on which to explain such tinnitus as occur in diseases of the middle ear, is that which is based on a morbid circulation of blood in and about the drum cavity, and the consequent morbid vibrations in the walls of the arterioles, which, when in excess, the ear interprets as sound, according to the accepted theory advanced by Theobold [1] of Baltimore.

When treating of wounds of the membrana tympani, the activity in healing of this part of the ear is alluded to, and is said to be greater than in any other part of the body. The membrana tympani is said to be the seat of minute interstitial abscesses, and it may be the seat of variolous pustules or of herpetic vesicles, and these, by inflaming the neighboring cellular tissue, may cause permanent openings in the membrane. The degree of deafness which follows is in no way proportionate to the extent of the perforation, as very often the writer has observed great hardness of hearing with small perforations, and only slight deafness with large perforations. The explanation of this fact, however, is not entirely satisfactory to our minds.

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[1] For explanation of these views see "Treatise on the Ear," by C. H. Burnett, of Philadelphia, 1877, p. 357.

"In both cases the decrease in hearing is marked, but it can be understood how that when the membrane presents a small opening with edges more or less thickened, which does not permit sonorous waves to pass, the conditions are so modified that physiological transmission is not accomplished by the chain of bones with their accustomed precision. When, on the contrary, the perforation is large, and when the loss of substance is attended by loss of the bones of hearing, sound-waves no longer meet with any obstacle, but strike directly on the fenestræ. It it true that in these cases the force of the waves of sound, instead of being condensed upon these inner organs, as the lens condenses the rays of light, is partly lost, and the deafness is always marked, though never complete."

In our opinion, in the first instance, with a small perforation with thickened edges, there is every reason to believe that there are inflammation and thickening of the mucous membrane within the cavity of the drum, and more or less retained exudation, both of which conditions will explain the inability of the auditory ossicles to act with their accustomed precision. In the case of the larger perforation the morbid process would be greater at the outset than in the former instance, and chiefly located in the membrana tympani, as shown in the extensive perforation in it. Through the latter, too, all exudations freely escape, and thus no impediment to the action of the ossicles from retained matter ensues. It is admitted that in the latter instance sound-waves can and do enter the drum-cavity, and impinging directly on the inner wall of the tympanum, make themselves heard, probably chiefly by their action on the foot-plate of the stirrup. The argument that a little perforation as such, without its attendants being considered, is more likely to make one deaf than a large perforation, as such, would, if extended, prove that no perforation in the drum-head is still worse and would induce the greatest deafness. In reality, perforations in the membrana tympani are only symptoms of what is going on inside the drum, excepting of course those known to be caused by external violence.

Allusion is made to the superannuated idea that in some cases a congenital opening exists in the membrana tympani, which Itard thought was a characteristic of some deaf-mutes; but the entire idea is rejected very rightly by Lacharrière. The generally accepted views concerning inflammatory diseases of the drum-cavity are then referred to, in the course of which hemorrhage into the drum-cavity is spoken of. "An effusion of blood into the cavity of the tympanum may come either from the mucous lining of the cavity, or it may enter the drum from the nasal fossæ. In order that the latter may occur, the hemorrhage must take place in or near the mouth of the Eustachian tubé; but usually the blood passes into the ear during the tamponnement of the nostrils, for the blood continuing to flow into a space hermetically sealed by tampons meets with a kind of pressure from resistance which forces it into the nearest accessible space. Usually, however, the accident is due to an injury

of some kind, as a fall or a blow on the head, or a lesion of the drum-cavity by a pointed instrument." Caution is here given, not to allow the clots to remain in the cavity, awaiting their absorption, for an organization of them is more likely to occur. It is vastly preferable, in the writer's opinion, to incise the drum-membrane and empty the cavity of the drum.

Various other well-known causes of defective hearing are alluded to, and then the most common instruments for aiding those who are permanently deaf are spoken of, the author terminating with some very just reflections on the audiphone. Having been greatly misled by newspaper articles as to the efficiency of this instrument, as well as by the reported results of experiments with it by Colladon, of Geneva, Lacharrière made some trials with it, but on deaf-mutes and on individuals who still possessed some hearing. In the former, who were connected with the National Institute, and who were examined in the presence of Drs. Hermet, Moure, and Jacquemart and M. Trouvé, a noted philosophical instrument maker, it was found that "*with their eyes closed, they in no instance could understand a solitary word pronounced in a loud voice in front of the audiphone.*" The experiments with those who still possess some hearing, showed that they gained no help from the audiphone worth noting. The writer then says, "In order to explain the differences in the results obtained by M. Colladon and myself, it must be assumed that the former was deceived, and also that lip-reading in some cases supplemented the inadequacy of the instrument. Respecting the Bell telephone, of which the author speaks at some length, he believes that an application of it may yet be made in lyceums and schools, whereby half deaf pupils may be admitted to classes from which they are now excluded by their infirmity. In political assemblies, certain parts of the room might be fitted up with telephonic wires running from the tribune, so as to enable those hard of hearing to hear the orator. In theatres certain loges might be specially provided with telephonic communication with the stage and set apart for the deaf, who would thus be enabled to overcome, in a measure, their infirmity, and enjoy the society of others. These are only hypotheses and hopes, but the theory justifies them and we dare count on their speedy realization."

Dr. Foulis brought before the Glasgow Pathological and Clinical Society (*The British Med. Jour.*, April 24, 1880) his method of examining the ear in *post-mortems* where, from want of time or permission of friends, or other causes, the ear could not be minutely dissected. Dr. Foulis believed that the ear was neglected at *post-mortem* examination; and it was to give a ready and rapid means of opening the middle ear that he brought the subject up. His method is with a chisel to split the petrous bone along a line parallel to the squamous plate, and falling on the outer slope of the eminence caused by the superior semicircular canal, the tympanum would be split open, together with the mas-

toid cells. In this procedure the stirrup is usually separated from the incus, and a good view is thus obtained of the parts in the tympanum, and also of the state of the mastoid cells. Should a particular examination of the inner ear be desired, the loose bit of the petrous bone might be again split in various directions, or examined more minutely in the way laid down in the books. This plan was not proposed as applicable to those cases where a previous history of ear disease and other circumstances indicated the need for a minute examination.

Dr. Johnson reports a case of septic infection of the lungs from necrosis of the petrous bone (*The Med. Times and Gaz.*, May 8, 1880), under his care at King's College Hospital. The patient was a boy aged 14. His history showed that there had been a discharge from his ear about six weeks before the commencement of the illness which ended in his death. Three weeks previous to his death he was taken with sudden headache, pain in the chest, and shivering, but no vomiting; three days later he applied to the out-patient department of the King's College Hospital, when it was observed that his gait was staggering, and he complained of headache and night-sweats. His general condition was bad and he was advised to become an in-patient, but declined. He was not seen again for two weeks (no account is given of the treatment during this interval); the night-sweats, however, had continued, and he had had cough and diarrhœa for three or four days. He was admitted to the hospital on April 7. He was then fairly sensible, and complained of headache, but began to wander toward evening. He became worse and sank rather rapidly, dying in the afternoon of the 9th. At the autopsy both pleuræ were found to be acutely inflamed, with recent deposits of lymph on both surfaces; each cavity contained a considerable quantity of thick, yellowish-looking fluid. Hemorrhagic infarctions were scattered throughout both lungs, especially at the surface; they varied in size from a pea to a walnut, and in some places had broken down into foul-smelling abscesses. The heart and pericardium were normal. Pus was found in the right internal jugular vein, and after removal of the brain a small abscess was discovered under the dura mater, in connection with the right petrous bone. The abscess was situated in the anterior portion of the right lateral sinus, extending from the apex of the petrous bone to the jugular foramen; the bone in the immediate vicinity of the abscess being denuded of dura mater. In the posterior portion of the right lateral sinus the blood had coagulated, but there was no pus. The petrous bone itself was much necrosed, the internal ear being entirely disorganized, and the cavity of the tympanum containing some soft whitish-looking material. In the brain the lateral ventricles were slightly dilated, and contained an abnormally large quantity of fluid. Otherwise the brain was normal. The details of this case, its progress after admission to the hospital, etc., are of interest, but

are necessarily omitted here. The close connection between the petrous portion of the temporal bone and the lateral sinus renders the absorption of septic material by the internal jugular vein exceedingly probable in cases like the above; and this accident obviously occurred in the present case, setting up purulent infarctions in the lungs, and double pleuritis. Attention is drawn in the report of this case to its resemblance during the last three days of life to that of a case of acute tuberculosis. It was noted, also, that although the disorganization of bone was advanced and of long standing, yet the amount of discharge from the external auditory meatus was very small, none being observed either when he was examined as an out-patient or during the days he was in the hospital.

Aneurism by Anastomosis of the Ear.—Mr. F. Eve exhibited to the Pathological Society (*Med. Times and Gaz.*, May 8, 1880) specimens and drawings illustrative of this condition. A congenital nævoid growth, having been neglected, gave rise to the aneurismal condition found in the patient whose age was twenty-one. At birth the tumor was pulsating, and occupied the upper part of the pinna. This gradually increased in size and was ligatured six years ago. Two years later a new portion of the growth at the back of the ear was unsuccessfully treated by pins, and when the patient came to the hospital the whole pinna above and behind the external auditory meatus was found to be involved, being enlarged, soft, of a dull red color, and pulsating moderately. A humming bruit could be heard on auscultation. The right common carotid, and the temporal and posterior auricular arteries were enlarged. The tumor became flaccid upon pressure on the carotid of that side. Hemorrhage had taken place several times. The whole pinna was removed by Mr. Thomas Smith.

The *Lancet*, June 19, 1880, says of "a box on the ears": At the Petty Sessions at Diss, last week, a lad nine years of age was convicted on a charge of illtreating a sheep. He was fined 1s., and 13s. costs, or, in default, fourteen days with hard labor. But, so the report runs, as the boy's mother said she had no money to pay, by direction of the Chairman she *boxed the boy's ears three times*, after which he was discharged on his mother paying 1s. damage. It is to be regretted that the magistrate, whose desire to mitigate a penalty which would fall upon the mother of the culprit, should have led him to prefer the infliction of corporal punishment in the way we have italicized, to a mode less liable to lead to serious consequences. We have protested—and not without reason—before now against the wrongful practice of "boxing ears," and we are sorry to find that ignorance of its sometimes baneful results prevail even upon the judicial bench.

Proposed Glasgow Hospital and Dispensary for Diseases of the Ear.—A public meeting of gentlemen interested in the formation of this insti-

tution was held on the 13th of May, 1880. Dr. Andrew Buchanan presided, and a constitution was presented for adoption. The President spoke with approbation of the management of the dispensary for diseases of the ear for the last seven years by Dr. Cassells, and stated that the object now was to extend their institution, and make it not merely a dispensary, but a hospital. He felt the necessity of teaching the rising generation of medical men to treat successfully the diseases of the ear. In moving the adoption of the constitution, the President also moved that the following gentlemen be the honorary medical staff: Dr. Peter Stewart, Senior Consulting Physician; Dr. James Morton, Senior Consulting Surgeon; Dr. Cowan Woodburn, Consulting Dental Surgeon; Dr. David Foulis, Consulting Surgeon for Diseases of the Throat; Dr. A. K. Irvine, Dr. A. L. Kelly, and Dr. John Gardner.

ON THE MORPHOLOGY OF THE INTERNAL EAR IN VERTEBRATA (*Fill Kännedomen om Innerorats Morfologi hos Ryggradsdjuren*). PROF. GUSTAV RETZIUS: *Nordiskt Medicinskt Arkiv*, XII., 12. 1880. p. 6, Stockholm.—In the above journal Retzius publishes some remarks on this subject in advance of a monograph on the organ of hearing in vertebrata, which will soon appear. Several years ago he described, in the labyrinth of bony fishes, a terminal nerve-apparatus which had not been mentioned before. It consisted of two small plates, situated in the posterior part of the utriculus, on its lower wall, and in it ended two nerve-branches, derived from the ramus cochlearis. At that time he considered it as corresponding to the pars basilaris of the higher vertebrata. His discovery was confirmed by Hasse. Further investigations proved the existence of this terminal apparatus in many teleostei (but not in all), in ganoidei, elasmo-branchii, and dipnoi. It was also found in all examined amphibia, from the lowest urodelia to the highest anoura, and, as a general rule, in a higher state of development. It constantly appears in reptilia, but less developed than in the preceding class, while in birds it is even more reduced and gradually disappears, and in mammiferæ no vestige of it can be found. Hence the name "pars basilaris" cannot be applied to it, neither can its position in the lower part of the utriculus justify a classification of it with the "pars initialis cochleæ." Retzius proposes, therefore, to call this terminal apparatus "macula acustica neglecta," and the nerve-branch "ramulus neglectus."

A real pars basilaris is not found in fishes, nor in amphibia (proteus, siren); it becomes more distinct in the higher urodelia (menopoma, siredon, triton, salamander); reaches still higher development in the anoura, where it forms a real membrana basilaris. It is about the same in the lower reptilia—chelonii, ophidii, saurii. In the higher saurii, especially the crocodile, it is more developed yet and assumes a spiral form. In birds and the lowest mammiferæ (monotremata) it remains about in the same degree of development, and finally in the higher mammiferæ it becomes the wonderful spiral apparatus which is found in the ductus cochlearis.

The author next speaks of the manner of division of the auditory nerve in different classes of vertebrata. In the lowest fishes (cyclostomi) the nerve is divided into two branches, an anterior and a posterior. This division is continued through all the higher classes of vertebrata, up to man. But even in ganoidei and teleostei there occurs a subdivision of these two branches, which is of great interest. The ramus anterior or vestibularis is subdivided into three, one for the recessus utriculi (ramulus recessus utriculi), and one each for the ampulla sagittalis and horizontalis (R. ampullæ sagittalis and horizontalis). The ramus posterior or cochlearis gives one branch to the sacculus (R. sacculi), another to the lagena cochleæ (R. lagenæ cochleæ), and one to the frontal ampulla (R. ampullæ frontalis). In most ganoidei and teleostei a small branch goes from the latter upward, and provides at the bottom of the utriculus the above mentioned "macula neglecta" (R. neglectus). The same obtains in elasmobranchii and dipnoi and in lower amphibia (proteus). In the higher urodelia there is also a ramulus basilaris for the pars basilaris cochleæ, and the same is the case with anoura and with all reptilia. In birds the division is the same, but the ramulus neglectus disappears, and it is not found at all in mammiferæ.

Hence, the same law of division governs from the ganoidei up to man. In all the N. acusticus is divided into two branches. The anterior or vestibular branch is again subdivided into three, one for the recessus utriculi, and one each for the ampulla sagittalis and horizontalis. The posterior or cochlear branch is divided into from three to five branches, one for the sacculus, one for the lagena cochleæ, and one for the ampulla frontalis; and in addition to these, in most fishes, in all amphibia and reptilia, and in some birds a branch, the "ramulus neglectus," goes to the utriculus, and lastly, in most amphibia, in all reptilia, birds, and mammiferæ, a branch, the nervus basilaris, goes to the pars basilaris cochleæ.

This description differs from that which is usually found in anatomical handbooks, in regard to the division of the N. acusticus in man. In some (Henle, Hyrtl, Luschka, Krause), all three ampullæ are provided by the ramus anterior or vestibularis; in others (Quain, Turner) the nerve-branch for the sacculus is derived from the ramus vestibularis, which is said to be divided into five branches, one for the sacculus, one for the recessus utriculi, and one for each ampulla, while the ramus cochlearis only provides the cochlea. Only Breschet, nearly fifty years ago, in "Études anatomiques et physiologiques—Sur l'organe de l'ouïe et sur l'audition," Paris, 1833, gives a description, corresponding with what Retzius found. J. J. B. V.

THE TREATMENT OF OTHÆMATOMA (*Zur Behandlung der Ohrblutgeschwulst*). WILLIAM MEYER: *Archiv für Ohrenheilkunde*, XVII., 2.—The common methods of treatment heretofore adopted for hæmatoma auriculæ are:

1. Expectant.

2. Resolvent (external applications of different kinds).

3. Surgical (evacuation of the blood by aspiration, acupuncture, incision with packing the cavity and a pressure-bandage, seton).

The proposition of Gray to ligate the arteria auricularis posterior is not known to have been attempted. As none of these methods afforded certain means of cure, and as opinions were variable in regard to which of them was the best, Meyer decided to try for othæmatoma the treatment which had been introduced by Metzger into rational medicine, and the result was so favorable that it is worthy of further trial. This treatment consists in systematic kneading of the effusion to assist absorption, and the application of a pressure-bandage which is worn continuously.

In three cases in which this was tried the result was very satisfactory; in two of them resorption took place within a few weeks, and a cure was effected without any deformity of the auricle. In the third case resorption had been nearly completed and the cure was progressing satisfactorily when the patient withdrew from observation. The three cases are given in full, and, aside from the method of treatment, are interesting contributions to the etiology of the disease.

The first case was that of a man, aged thirty-four, strong, not plethoric, and perfectly healthy, as was shown by a thorough physical examination. His father, however, was insane (religious melancholy) at sixty-four years of age, and died a year later. One and a half month before the patient applied for treatment, without previous injury of any kind, a hard insensitive nodule appeared on the left auricle, which increased in size gradually, and became fluctuating without any change in the skin and without pain, tension, or sensitiveness. This was incised and dark fluid blood evacuated. From this time the tumor filled rapidly, became sensitive, and was accompanied by headache. It was again incised three days later and the cavity stuffed with charpie, but the pain increased, extending to the temple, vertex, and nape of the neck. On examination by Meyer after this, in addition to the hæmatoma, the whole auricle was much inflamed, and this inflammation was first reduced by continuous applications of lead-water. Massage was then begun four times a day, and continued for a quarter of an hour each time, the skin being first anointed with glycerine-salve. Between times the auricle was kept firmly compressed between masses of charpie by means of a bandage over the head. Massage was stopped as soon as it produced pain, but except the first day was well borne for the whole fifteen minutes. One week after, the hæmatoma had almost disappeared, the skin was freely movable on the cartilage, but there was a slight thickening of the ear. Massage and the pressure-bandage were continued for some weeks. Ten weeks after treatment the auricle was absolutely perfect, except a very slight thickening.

The second case was in the same patient, but on the right auricle, one and a half year later. The tumor began in the same way, and the diagnosis was confirmed by aspiration. The same treatment was used, but only twice a day, and in three weeks the ear was well and both auricles were perfect four years after.

The third case was in a woman, aged thirty-four, and the tumor was the result of a blow. She herself was perfectly healthy, but her mother had been insane. The same treatment was used, and the tumor had almost disappeared when she withdrew from observation.

In all these cases, external evidence of a degeneration of the cartilage was wanting; the existence of any predisposing disease was absent, and the only cause to be discovered was in the history of the patients, in both of whom the parents had been insane. Hun's observation, that the appearance of othæmatoma in sane persons usually precedes a later mental disturbance, and Roosa's, "that although persons suffering from vascular tumor of the ear may not always be insane, they generally have brain disease," is worthy of special attention in this connection, Meyer says.

Atresia of the Meatus Auditorius Externus and Absence of both Auricles (*Atresia del Conducto Auditivo y Falta de Ambos Pabellones*). Dr Antonio Fernandez Palacios: *Revista de Medicina y Cirugía prácticas*, IV., N. 99, p. 105. Madrid.—The patient was a girl of twelve, of good constitution, although not strongly developed. Parents are healthy and no hereditary predisposition to disease could be determined. It was observed at birth that there were small, shallow eminences, hardly perceptible in the place commonly occupied by the auricles. The lobule was somewhat more distinct. The parents believed that in time the auricle would develop naturally, and proceeded to perforate the lobule for insertion of ornaments. This created a severe inflammation, which was renewed with every repetition of the attempt at perforation, until finally it was given up.

The absence of the auricle and atresia of the meatus created the fear that the child would be a deaf-mute. But it was soon discovered that sounds made an impression even at a distance, and when the attention of the child was not otherwise attracted. At two years she began to talk as much as is usual with children of that age, only, in order to hear distinctly, she opened the mouth widely, as if to signify that in this manner she could hear more perfectly. An operation had often been proposed, but it had been constantly refused.

The girl had an animated appearance, lacking entirely the half-stupid expression so common in the deaf. At the left side, in the place commonly occupied by the auricle, there appears a cartilaginous appendix, 3 ctm. long, and 1 ctm. in transverse diameter, irregular in form, composed of four small cartilages, united by a fibrous tissue, and presenting the appearance of an ex-

cavation in the centre, and two eminences at the extremities. The lobule is more distinct and in its proper place, although turned slightly forward and inward. But there is complete absence of the exterior opening of the auditory meatus, neither is its existence indicated by any depression over the place where it should be situated. The aspect of the appendix is as if the ear had been folded from behind forward toward the zygomatic region. The anterior part of the apophysis mastoidea, generally covered by the concha, is in this case uncovered, and the tragus and anti-tragus appear to be united in one piece, corresponding with the lowermost of the cartilaginous projections above mentioned.

On the right side the auricle is also absent, and is replaced by a fibro-cartilaginous appendix of somewhat larger dimensions than on the left. In its superior part it bears a small excavation, formed by a fold of the cartilage, which admits the point of a probe. There is entire absence of the external orifice of the meatus, and without interruption the skin covers the whole appendix.

As soon as the patient perceived a sound, she instinctively opened the mouth widely. It could be ascertained, however, that sounds reached the ears also when the nose and mouth were closed, but in this case sentences spoken in a low voice, with the observer standing behind the girl, so that the movements of the lips could not be seen, were heard indistinctly. The author of this communication believes that the Eustachian tube may act in this case as a kind of supplementary external ear, increasing resonance, and in this manner producing another example of compensatory action, as is so frequently found in other organs. J. J. B. V.

Observations on Central Affections of the Acusticus (*Beobachtungen über centrale Acusticus Affectionen*). Urbantschitsch: *Archiv für Ohrenheilkunde*, XVI., 3.—Four cases of disease referred to a central affection of the acoustic nerves are given which, with the discussion on the differential diagnosis of some of them, are of great interest. The first is one of the class of cases which have excited so much interest in the last few years, especially in Paris, and have been made the subject of investigation by the Société de Biologie, and by Charcot, in their general relations, although we believe this is the first investigation of the condition of the ears in one of them. A woman, aged twenty-five, entered Prof. Rosenthal's wards in Vienna, in 1878, for hysterical attacks with pain in the back, left intercostal region, and aphonia. In October, 1879, she was attacked with paresis of the right arm and anesthesia of the left side of the head, a complete mechanical and electrical insensibility of the skin, muscles, and nerves existed. The eye of the left (anesthetic) side was amblyopic, only light and darkness being recognized, and the pupil of that eye was more sluggish than the other. Metalloscopic experiments were negative, but a small magnet applied to the sensitive side produced, after some minutes, a

transference of all the symptoms to that side. During this transference the perception of color returned to the left amblyopic eye and was lost in the right; the restoration beginning with red, then blue, yellow, orange, green, and violet respectively, and the loss being in opposite order, violet, green, orange, yellow, blue, and red. In September, 1879, she also suffered from great pain in the head and serious disturbance of equilibrium coming on suddenly, and often accompanied by vomiting and intense subjective noises of dull roaring in the right ear, but without any loss of consciousness. The vertigo was regularly intermittent, coming on at 4 P.M., and lasting into the night.

Examination of the ears showed the drum-membrane slightly thickened and drawn in; auscultation was impossible, from the vertigo which inflation produced. A deafness in the left ear was total, neither tuning-forks nor words being recognized, and a galvanic current of 40 elements, Siemens and Halske, produced no reaction. The tuning-fork on the head was heard entirely in the right ear. The right ear was somewhat deaf, the watch giving $\frac{36}{150}$, and words were understood at five paces, but there was hyperæsthesia as the sounds produced vertigo. The phenomena of the transference in the ears was as follows: on placing a small horse-shoe magnet directly upon the left mastoid, and bringing it within some millimetres of the hyperæsthetic right mastoid, complete deafness followed in the right ear, in from five to eight minutes, and the left became as good and no better than the right had previously been. This same transference occurred also in the eye and in the anæsthesia of the skin. Closer investigation showed that after the application of the magnet for four minutes, the roaring in the right ear diminished, and in a few seconds began in the left ear; this was followed by a gradual perception of high tones in the left, and loss of these tones in the right ear till the hearing was equal in both; the deeper tones were then gradually perceived in the left as they were lost in the right, and the subjective roaring was transferred entirely to the left. After about six minutes the ears returned to their previous condition. Five minutes after the same phenomena of transference occurred without the use of the magnet, disappeared in three minutes, and again in five minutes returned for the third time to last only one minute. These same waves of irritation which were here noted in the ears, had been previously observed in the general symptoms in other cases by Charcot and Rumpf.

It is impossible, in this place, to note all the precautions which were taken to guard against simulation, but they seem to have been complete, and both Rosenthal and Urbantschitsch were satisfied that no simulation existed. No explanation of the case is attempted, but attention is called to the assertion of Rumpf that a similar physiological transference may take place in a healthy person by compression of an artery in one limb, which Rumpf considers, from his experiments in frogs, to be due not to an influence on the vessels but on the nerves. The case seems to be an inexplicable and unique one.

The second case was one of total deafness for speech in a syphilitic person, and was cured. A man, thirty years old, whose hearing had never been acute, and who had had intermittent, subjective noises for years after exposure in the snow, awoke the next morning with deafness and violent subjective noises. There was a history of syphilis four years before. The deafness for speech was total, but the watch was heard on the right 8 ctm., but on the left not at all. The tuning-fork on the head was heard slightly. Examination showed the drum-membranes slightly thickened and drawn in, but without signs of acute inflammation. For two months before there had been brain symptoms, headache, drowsiness, and diminution of vision. The diagnosis was chronic catarrh of the tympana with a sudden affection of the acusticus. As the deafness and noises were not associated with vertigo and vomiting, the semicircular canals were intact, and apoplectic deafness was excluded. As the acoustic did not react to the galvanic current—20 elements, Siemens and Halske—and as the deafness for speech was total, the whole cochlear nerve must have been involved. As the watch could be heard somewhat, and as this improved from the use of the galvanic action of the anode, without improvement for speech, however, all the fibres of the acoustic could not be involved. These facts, taken in connection with the brain symptoms, pointed, Urbantschitsch thinks, to a central affection, especially as examination of the eyes showed choroiditis syphilitica. Potassium, iodide, and mercurial inunctions were used, and in about three months the patient recovered.

The third case is one of bilateral deafness from a slight injury in a boy, nine years old, who received a light blow from a spoon in the hands of another child upon the temple, followed by violent bleeding from the nose, and vertigo, which disappeared in a few days. Nine days after, having heard perfectly well before, he awoke totally deaf, and so remained without any improvement. From the bilateral character of the deafness, and its suddenness, Urbantschitsch thinks it probable that a hemorrhage occurred in the region of the fourth ventricle, or in the medulla oblongata, and refers to Durets' experiments, as showing the possibility of this from a blow on the head.

The fourth case is one of sudden deafness after a profuse hemorrhage from the nose, in a man sixty-seven years old. The hemorrhages recurred for three days without known cause, when the patient became suddenly, totally deaf in both ears, and had subjective noises without other symptoms. Examination gave a negative result. The deafness was total for all tests. The patient died one month after, of what disease is not stated, and a macroscopic examination of the ears showed no pathological condition, while a careful microscopic examination of the whole brain was equally negative in result.

Cases of amaurosis after hemorrhages have been frequently observed, and are referred by Nägeli partly to anæmia of the optic nerves, partly to nutritive disturbances in the thalamus or vaso-motor centres of the eye. This is the first

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report of total deafness after hemorrhage, and the early death of the patient gives no clue to the prognosis, but in amaurosis from similar causes, of 91 cases, 47 per cent. showed no improvement, 30.8 per cent. some improvement. and 20.9 per cent. perfect restoration.

OTORRHŒA OF FOURTEEN YEARS' STANDING—RECOVERY (*Una Ottorea de Catorce Años de Existencia—Curacion*). DR. B. ALVAREZ: *Revista de Medicina y Cirugía prácticas*, IV., N. 101, p. 190. Madrid.—In a case of otorrhœa of fourteen years' duration, there was found a fibro-gelatinous polyp filling the entire meatus and almost protruding from it. It was removed with Wilde's snare, and found to start from the membrana tympani. The communication is of no special interest to otologists, but being published in a general medical journal the author has occasion to call the attention of the profession to the dangers attending either the organ of hearing or life itself. From lack of knowledge to diagnosticate so clear and simple a case, it had been pronounced "scrophulous humor." The author's tirade against this diagnosis, and against the "medical" advice which prevents a treatment of purulent discharge, because the *humor* might settle in some more delicate organ, will sound quite natural to most otologists. J. J. B. V.

BIBLIOGRAPHICAL INDEX.

Books.

"Des champignons parasites de l'oreille humaine." Lu au Congrès de Reims (Association Française, 1880), Dr. Löwenberg, Paris. Pp. 7.

"Diseases and Injuries of the Ear," N. B. Dalby. Second ed. J. & A. Churchill, London, 1880.

"Deafness, Giddiness, and Noises in the Head," Woakes. Second ed. Presley, Blakiston & Co., Philadelphia, 1880.

"Diagnosis and Treatment of Ear Diseases," Albert H. Buck. William Wood & Co., New York, 1880.

"Otitis media non-suppurativa chronica" (read before the Maine Medical Association, June 15, 1880), E. E. Holt. Stephen Berry, printer, Portland, Me.

Journals.

External Ear.

"A Case of Primary Post-Aural Abscess without Implication of the Middle Ear," F. C. Hotz: Archives of Otology, IX., 250.

"Perichondritis Auriculæ," H. Knapp: Archives of Otology, IX., 195.

"Zur Behandlung der Ohrblutgeschwulst," M. Meyer: Archiv f. Ohrenheilkunde, XVI., 161.

"Notes on a Rare Case of Otitis Externa Parasitica," R. Torrance: Med. Press and Circular, London, XXX., 131.

"Accumulation of Cerumen simulating Post-Nasal Catarrh," W. M. Fuque: Am. Practitioner, Sept., 1880.

"Removal of Fibrous (Cicatricial Keloid) Tumor of the Lobule of the Ear," F. M. Pierce: Med. Times and Gazette, Sept. 18, 1880.

"Cases of Ivory Exostoses of the Ears Successfully Operated Upon," George Field: Med. Press and Circular, Oct. 27, 1880.

"Zur Behandlung der Ohrpolypen," A. Politzer: Wien. med. Wochenschrift, No. 31, 1880.

"Foreign Bodies in the External Auditory Canal," C. H. Burnett: Philadelphia Med. Times, Oct. 9, 1880.

"A Modified Tip and Protecting Flange applied to the Ear-Syringe," O. D. Pomeroy: Med. Record, Sept. 4, 1880.

Middle Ear.

"Three Cases of Rupture of the Membrana Tympani," C. R. Agnew: Med. Record, XVIII., 169.

"An Analysis of Five Hundred Cases of Perforation of the Membrana Tympani," G. P. Field: Med. Press and Circular, XXX., 85.

"Perforation of the Membrana Tympani from Ascaris Lumbricoides," L. W. Reynolds: London Lancet, Oct. 22, 1880.

"Cases of Otorrhœa," N. W. Seeley: Lancet and Clinic, Oct. 9, 1880.

"Suppurative Inflammation of the Middle Ear," J. H. Curry: Toledo Med. and Surg. Journal, IV., 241.

"Dry Treatment of Otitis Media Purulenta:" Editorial St. Louis Courier of Medicine, IV., 180.

"Chronic Purulent Inflammation of the Middle Ear and Abscess of the Brain existing Independently of Each Other," J. Michael: Archives of Otology, IX., 226.

"Otitis Media Purulenta, with Necrosis of the Inner Wall of the Tympanum and of the Mastoid Process," J. Michael: Archives of Otology, IX., 222.

"Otite moyenne purulente double, osteite des apophyses mastoïdes et de la région des rochers avoisinant la caisse pus dans les labyrinthes," M. Noguet: Bulletin méd. du Nord, Feb., 1880.

"A Contribution to the History of Necrosis of the Temporal Bone," C. Vieller: Berliner klin. Wochenschrift, No. 44, 1880.

"Disease of the Mastoid Bone; Herpes of Face, with Thrombosis of Lateral Sinus," Morris: Lond. Lancet, June 26, 1880.

"The Pathology of a Case of Fatal Ear Disease," P. McBride and A. Bruce: Jour. of Anat. and Phys., London, XIV., 360.

"Inflating the Ear," J. O. Dyer: Medical Herald, Sept., 1880.

"A Modified Inflator for the Middle Ear," Edgar A. Brown: London Lancet, Aug. 14, 1880.

"The Method of Air-Supply to the Middle Ear, the Density of the Air in this Cavity, the Cause of the Uniform Concavity of the Membrana Tympani, and the Functions of the Eustachian Tube," Thomas F. Rambold: St. Louis Med. and Surg. Journal (cont. from p. 156), Aug. 20, 1880.

Internal Ear.

"Étude sur la structure du ligament spiral externe et les attaches de la membrane de Corti," Gellé (Société biologique): Gaz. méd. de Paris, April, 1880.

"Compound Fracture of the Petrous Bone, caused by a Revolver Bullet; Meningitis; Death," E. M. James: Melbourne Hospital Reports, Australian Med. Jour., Sept. 15, 1880.

"An Abnormal Condition of the Semicircular Canals," P. McBride: Jour. of Anat. and Phys., London, XIV., 198.

"Croupous Inflammation of the Cochlea," P. McBride: Jour. of Anat. and Phys., London, XIV., 195.

"Facial Paralysis and Labyrinthine Vertigo," C. G. Comegys (Clinical Lecture, Cincinnati Hospital): Med. Record, April 24, 1880.

"Lecture on Auditory Vertigo," J. Hughlings Jackson: London Lancet, Oct. 2, 1880.

"Vertige auriculaire," V. Revillout; "Vertigo ab aure laesa," V. Revillout: Gaz. des hôpitaux, LIII., 697–745.

MISCELLANEOUS.

"Fracture of the Temporal Bone," A. H. Buck (read before the Med. Soc. County of New York, Remarks by S. Sexton): Med. Record, Oct. 16, 1880.

"Post-mortem Examinations of the Ear, and the Frequency of Disease in or near the Tympanum," David Foulis: Br. Med. Journal, Oct. 16, 1880.

"Scarlet Fever as a Cause of Ear Disease:" (Editorial) Med. Times and Gazette, Oct. 30, 1880.

"Cold as a Cause of Deafness," Theodore Griffin: St. Louis Med. and Surg. Journal, Oct. 5, 1880.

"On the Sympathy existing between the Ear and the Larynx, and the Ear and the Teeth," C. H. Burnett: Specialist and Intelligencer, Nov. 1, 1880.

"Des affections auriculaires et de leurs rapports avec celles de l'utérus," J. Baratoux: Tribune médicale, No. 606.

"Remote Effects of Diseased Teeth," William D. Kempton: Lancet and Clinic, Oct. 16, 1880.

"Forms, Causes, and Treatment of Tinnitus Aurium: W. Douglas Hamming: Br. Med. Journal, Sept. 25, 1880.

"Tinnitus Aurium," discussion by Drs. Todd, Pollak, and others before the St. Louis Medico-Chirurgical Society: St Louis Courier of Medicine, Sept., 1880.

"The Audiometer, the Dentaphone, and the Audiphone," J. Orne Green (read before the Boston Soc. Med. Sciences): Boston Med. and Surg. Journal, Nov. 11, 1880.

"Ueber das Audiphon und seine Verwendbarkeit bei Schwerhörigen," D. Czarda: Wiener med. Presse, July 25, 1880.

"L'audifono, l'elettrofono e il sordo-muti," D. Bargellini: Imparziale, XX., 367.

"Otological and Ophthalmological Cases," M. F. Coomes: Med. and Surg. Reporter, Oct. 28, 1880.

"Report of the Otological Congress at Milan:" Br. Med. Journal, Oct. 16, 1880.

"Transactions of the American Homœopathic Ophthalmological and Otological Society, Fourth Annual Meeting," Bigelow Bros.: Buffalo, N. Y., 1880.

"Beiträge zur Verletzung des Gehörorgans," W. Kirchner: Aerztl. Intelligencer Blätte, XXVII., 325.

"Beobachtungen ueber centrale Acusticus Affectionen," V. Urbantschitsch: Archiv für Ohrenheilkunde, XVI., 171.

"Ueber den Werth des Nitze-Leiter'schen Endoskopes zur Untersuchung des Gehörorgans," E. Zaufal: Archiv für Ohrenheilkunde, XVI., 1880.

ANNOUNCEMENT.

In issuing the first number of the third volume, the editors of the American Journal of Otology desire to present to its subscribers and contributors a statement of the work already accomplished in establishing the Journal upon a firm basis, and in insuring its future success.

The incentive to the founding of this journal was the newly developed interest in the subject of acoustics, and the rapid growth of the special branch of medical science to which the Journal is devoted. Its objects were to encourage, in this country, original investigations in the domain of Otology, in the widest sense in which that term may be applied, and to furnish its readers, in addition, with as complete a *résumé* as possible of the otological work of other lands.

For the accomplishment of these purposes it is the endeavor of the editors to secure to the Journal such relationships, not only with other journals for purposes of exchange, but also with scientific societies and academies, as shall afford to contributors the widest distribution of their work in directions in which good original work would be best appreciated, and, by division of labor in reviewing among the members of the working staff of the Journal, to make the review department a complete record of the more important otological contributions in all languages. That these objects have been in a measure accomplished is attested by the character and scope of the original communications in the preceding volumes, and by the relationships already established with the scientific institutions and journals included in the list herewith appended.

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Archives of Otology, New York, N. Y.
Medical Record, New York, N. Y.
St. Louis Courier of Medicine, St. Louis, Mo.
American Journal of the Medical Sciences, Philadelphia, Pa.
Journal of the Franklin Institute, Philadelphia, Pa.
Scientific American, New York, N. Y.
Practitioner, London, England.
Birmingham Medical Review, Birmingham, England.
Australian Medical Journal, Melbourne, Australia.
Revue des sciences médicales en France et à l'étranger, Paris, France.
Lyon médical, Lyon, France.
Annales des maladies de l'oreille, du larynx, etc., Paris, France.
La tribune médicale, Paris, France.
Revue scientifique de la France et de l'étranger, Paris, France.
Giornale della reale Accademia di Medicina di Torino, Turin, Italy.
Revista de Medicina y Cirugia Practicas, Organo Oficial de la Academia Medico-Quirurgica Jerezana, Madrid, Spain.
El Progreso Medico. Revista de medicina cyrugia, farmacia, ciencias, auxiliares hygiene y medicina legal, Madrid, Spain.
Cronica Medico-Quirugica de la Habana, Havana, Cuba.
Gazeta Medica da Bahie, Bahia, South America.
Revista Medico-Quirurgica, Buenos Aires, South America.
La Emulation. Periodico de la Sociedad Medico-Farmaceutica, Yucatan, Mexico.

O Correio Medico de Lisboa, Lisbon, Portugal.

Schmidt's Jahrbücher der In- und Ausländischer Gesammten Medicin, Leipsig, Germany.

Monatschrift für Ohrenheilkunde, Berlin, Prussia.

Archiv für Ohrenheilkunde, Halle, Germany.

Norsk Magazin for Laegevidens-Kaben, Christiana, Sweden.

Upsala Läkareforenings Förhandlinger, Upsala, Sweden.

Revue mensuelle de laryngologie, otologie et rhinologie, Bordeaux, France.

NOTES.

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The subjects for discussion by the Otological Section of the International Medical Congress, to be held in London in 1881, are the following: 1. On the Value of Operations in which the Tympanic Membrane is Incised. 2. On Morbid Growths within the Ear and their Treatment. 3. On Loss of Hearing where the External and Middle Ears are Healthy.

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ORIGINAL COMMUNICATIONS.

SOME RECENT INVESTIGATIONS OF THE HISTOLOGY OF THE SCALA MEDIA COCHLEÆ.

BY CHARLES SEDGWICK MINOT.

IT is well known that in the lower animals the auditory apparatus consists of a simple involution of the ectoderm, which forms either an open pit or a closed sac—otocyst. In vertebrate embryos the ear is likewise an invagination of the outer germ-layer, which makes first an open pit, and then closes to form a globular vesicle, which is lined by a simple epithelium, and is imbedded in the mesoderm. This primitive otocyst becomes in mammals the membranous labyrinth, consequently the whole labyrinth is lined by a columnar epithelium of ectodermal origin. The auditory cells (Corti's and Deiters', or the hair-cells) of the *scala media* of the cochlea are produced by the differentiation of this epithelium. The *membrana basilaris*, upon which rests the organ of Corti, is derived from the mesoderm, consists of fibrous connective tissue, and possesses no sensory functions of audition.

Our knowledge of the histological development of the cochlea rests principally upon the elaborate investigations of Böttcher,[1]

[1] Böttcher, Arthur: Ueber Entwickelung und Bau des Gehörlabyrinthes nach Untersuchungen an Säugethieren. Nova Acta L. C. Acad., xxxv., 1869. Abhd. v., pp. 203. Tafn. xii.

which have been confirmed by Gottstein, Kölliker, Pritchard, and others. The beginnings (*Anlagen*) of the *Aqueductus vestibuli* and of the vertical semicircular canal are the first outgrowths of the primordial vesicle to appear. The cochlea is the third part. (Sheep embryo 1.6 ctm. long.) It grows from the lower side of the vesicle downward and inward, as a canal flattened in its vertical diameter, and therefore oval in transverse section. By further elongation and coiling this canal gradually assumes the final shape of the *scala media*.

The histological development of the cochlea is the same throughout its entire length, but progresses most rapidly at the base, or the stretch nearest the vestibule, and lags gradually more and more toward the tip.

The first change in the epithelium is in the height of the cells—those upon the upper side thin out; in other words, that portion of the epithelium decreases in thickness (Plate I., A), remains a permanently simple columnar epithelium, and forms the lining of one side of Reissner's membrane, and of the outer wall of the scala. The lower portion of the epithelium, which remains thicker, forms the *crista*, *sulcus*, and Corti's organ. The two divisions of the epithelium are not sharply separated, but pass gradually into each other.

The second change is that the loss in thickness of the epithelium is continued on the under side, or the wall next the *scala tympani*, so as to leave two thick epithelial ridges of very unequal dimensions (Plate I., B). The larger ridge, *m*, lies nearest the *columella*, and becomes the thick lining of the *sulcus spiralis*. It very early acquires a thick cuticula, the beginning of the *membrana tectoria*. The smaller ridge, *c*, lies nearer the *ligamentum spirale*, and is metamorphosed into the organ of Corti, including the supporting cells, the inner and outer hair-cells, and Corti's rods. Very soon after the two ridges are distinctly formed, the *lamina spiralis* begins to grow up between the *sulcus* or broad inner ridge, and the axis of the cochlea to develop into the *crista*. The epithelium on the *crista* is thus maintained with its upper surface even with that of the *sulcus*. Over both parts stretches the cuticula, which gradually thickens into the fully developed tectorial membrane, which

probably has at no time any histogenetic connection with the organ of Corti,[1] although it grows out so far as to overhang it. The membrane always remains firmly attached to the *crista*, but is loosely united to the epithelium of the *sulcus internus*, and in the adult it is probably entirely separated from the *sulcus*, and attached only to the *crista*. From some unknown cause the lower boundary of the epithelium of the *crista* becomes indistinguishable. The cells in the *sulcus* apparently assume an oblique position, so that in sections there seem to be several layers of cells. Middendorf and others have been misled to describe a stratified (*mehrschichtiges*) epithelium in the *sulcus*.

The smaller ridge is made up of four sets of cells, disposed in longitudinal rows. The two rows nearest the *sulcus internus* are composed each of a single line of cells. The third row is in most mammals three cells, the fourth or outermost row several cells wide. The first row forms the inner hair-cells; the second, Corti's rods; the third, the outer hair-cells; the fourth, the supporting cells. The development of these parts is followed best in transverse sections of the ridge, and in the following description reference is made to the appearances seen in such sections.

The inner cell slopes toward the centre of the ridge, has a broad base and narrower top, and originally has a single, clear, oval nucleus at its basis. The upper part becomes the inner hair-cell, with a distinct nucleus of its own, a somewhat coarsely granular protoplasm, and a horse-shoe[2] of hairs upon its free upper surface, and a tapering base, which last is really the constricted middle of the original cell. The base of the cell also acquires one or, according to Böttcher, two nuclei, becomes finely granular, and corresponds to Waldeyer's *Körnerschicht*. The structure of the fully developed inner cells is still imperfectly understood.

The second cell is likewise broadest at the base, where lies the spherical nucleus. The base widens out rapidly (immediately after birth in dogs) until the whole cell becomes triangular in outline,

[1] Kölliker: Entwickelungsgeschichte, 2te Aufl., 728–731.

[2] When the auditory cells of Corti's organ are viewed from the surface, the hairs are seen to mark out a horse-shoe on the top of each cell. The open end of the horse-shoe always faces inward, *i.e.*, toward the columella.

and the width of the base exceeds the height. Meanwhile the nucleus divides, and the two daughter-nuclei place themselves near the two lower angles of the cells. Next the cell becomes striated: 1st, along the inner side; 2d, along the outer side of the triangle. These striated lateral portions form the two Corti's rods, in the restricted sense. The triangular space between the rods and the basement-membrane is filled with protoplasm. Very soon the central portion is hollowed out, thus forming the tunnel under the arching rods. The protoplasm is next reduced to two small nucleated masses, one at the base of each rod. The further development takes place principally by the growth of the rods, until they assume their ultimate shape and size. Recent investigators have added little to the account of the structure of Corti's rods given by Waldeyer.[1]

The third band, which is three cells wide, forms the outer hair-cells. Like the other cells, they first acquire two nuclei—a larger oval one above, and a smaller one below. This was first observed by Pritchard.[2] The two parts around the two nuclei early become separated into an upper cell (the Corti's cell, or *absteigende Hörzellen*) and a lower cell (Deiters' cell, or *aufsteigende Hörzellen*).

The base of the upper cells is at first rounded off, but subsequently a fine process extends down to the *membrana basilaris*, and the base tapers gradually into the process. The cells become slenderer, and acquire an oblique position about the time of birth. The rod (Stäbchen or Haupthaar) and the horse-shoe of hairs are developed upon the free ends of the cells during the later stages of fetal life.

The lower cells taper at their upper ends, which are continued by a fine process. They are found united, in the adult, with the upper cells, thus forming twin-cells, which have been most fully described by Lavdowsky[3] and Nuel.[4] The development of these

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[1] Waldeyer: Stricker's Handbuch der Lehre von den Geweben, 1872, 931–934.

[2] Pritchard, Urban: The Development of the Organ of Corti. Journ. of Anat. Physiol., XIII., pp. 99–103, Pl. I.

[3] Lavdowsky, M.: Untersuchungen über den akustischen Endapparat der Säugethiere. Arch. für. mikros. Anat., Bd. XIII., pp. 497–557., Taf. xxxii.–xxxv.

[4] Nuel, J. P.: Recherches microscopiques sur l'anatomie du limaçon des mammifères. Mém. Couron. Acad. Belg., 1878, pp. 84, Pl. I.–IV.

twin-cells is by no means clearly understood yet. The upper and lower cells appear distinctly separate in new-born and young animals. The upper cells enlarge at the expense of the lower. The nucleus becomes smaller and is placed near the top of the cell. The rod (Haupthaar) disappears. The horse-shoe of hairs opens toward the Corti's rods, as can be best seen in silver preparations. The hairs are more like short rods, vitreous, with rounded ends, and are parts of the cell, not of the *membrana reticularis.* The basal process of the upper cell is inclosed by (Lavdowsky), or fused with (Nuel), the body of the lower cell. The tops of the upper cells (Corti's, absteigende, or Stäbchenzellen Lavdowsky) occupy the rings, the tops of the processes of the lower cell occupy the phalanges of the *membrana reticularis.* The lower part of the united cells appears as their common body, and contains the lower nucleus. The nerve-fibre unites with the cell at the side near the lower nucleus. The twin-cells end below by a single basal process. The above account is mainly from Lavdowsky. Nuel agrees with him in the main, but the latter's paper I know only from the abstract in Hofmann's and Schwalbe's "Jahresbericht."

Connected with the outer hair-cells are various structures, which are probably to be grouped under the general head of intercellular formations. Of these, the most important are the "*Stutzfasern*" (supporting fibres) and the *membrana reticularis.* The latter is generally regarded as the exposed edges of the intercellular substance, the rings and phalanges being the spaces where the free ends of the hair-cells are exposed. The "Stutzfasern" form a network underneath the tunnel (Plate I., *s.f.*), and also a finer network between the outer hair-cells (Plate I., 5). They were dimly recognized by Böttcher, clearly seen by Nuel,[1] and elaborately described by Lavdowsky.

The fourth row of cells undergo no striking differentiation, but decrease gradually in height from the hair-cells outward, so that they pass gradually into the low cells of the *zona pectinata.* Klein[2] states that in the guinea-pig the supporting cells do not

[1] Nuel: Beiträge zur Kenntniss der Säugethierschnecke. Arch. f. mikros. Anat., VIII., p. 200.

[2] Klein: Atlas of Histology, p. 401, Pl. XLV., Fig. 3.

form, as is usually the case, a simple continuation of the last row of the outer hair-cells, but ride upon the sides of the hair-cells.

According to the preceding summary the cochlea is a tubular extension of the lower side of the primitive ectodermal otocyst; upon one side of this tube are two ridges: a larger one, which forms a thick cuticula, the *membrana tectoria;* and a smaller one, which, through complicated differentiations, becomes the organ of Corti. The nerves grow *to* the hair-cells.

Paul Meyer, in his work on the cochlea of reptiles and birds,[1] has drawn some interesting generalizations concerning the morphology of the hair-cells. I have not seen the original memoir, but rely upon the abstract given in Hofmann and Schwalbe's "Jahresbericht." According to Meyer, the auditory hair-cells are always elongated; the hairs are of two kinds: 1, several smaller and shorter hairs; 2, one main hair much larger than the rest. Three modifications occur: in the cochlea the short hairs are especially developed; in the *lagena*, *sacculus*, and *utriculus* the two kinds are more equally developed; in the *ampullæ* the main hair is most prominent, and the small hair may disappear entirely.

Finally, Hasse has given, in the Supplementheft of his "Anatomische Studien," a general review of the morphology of the vertebrate ear. I regret not to have yet had access to this work.

The section of the cochlea of a young dog, figured in this article, is copied from Lavdowsky (*l. c.*, Pl. XXXIII., Fig. 2), and is one of a series of illustrations prepared for a work on comparative histology, upon which I am engaged. Lavdowsky's figure is to be considered the best yet published. It shows, besides features described above, the following peculiarities: the *ganglion spirale*, *G*, and the nerve, *N*, traversing the *lamina ossea*, *L.os.* The nerve is composed of medullated fibres, which break up into naked branching axis-cylinders, immediately after passing through the *habenula*. The ganglion is composed principally (entirely?) of bipolar cells. The *crista*, *Cr.*, presents a very different texture

[1] Meyer, P.: Étude histologique sur le labyrinthe membraneux et plus spécialment sur le limaçon chez les reptiles et les oiseaux. Strassbourg et Paris, 1876, pp. 189, Taf. I.–IV.

Plate I.

THE FORAMINA OF THE MASTOID EMISSARY VEINS.

By J. ORNE GREEN, M.D.,

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With the object of determining the constancy, size, position, and number of the foramina of the emissary mastoid veins, which furnish a direct communication between the lateral sinus and the venous circulation of the superficial tissues of the neck, and which are occasionally involved in inflammations of the sinus produced by disease of the ear, I have examined, through the kindness of Dr. Whitney, the curator, a number of skulls in the Warren Museum of the Harvard Medical School.

Only those skulls were used which were in perfect condition, and which had also been sawn open so that both the external and internal openings could be seen, and the foramen be thus proven to enter the sulcus of the lateral sinus.

A scale of six sizes was adopted, viz., 5 mm. in diameter, *enormous;* 4 mm. *very large;* 3 mm. *large;* 2 mm. *medium;* 1 mm. *small;* 0.5 mm. *minute.* In regard to the position of the foramina, they are always just behind the posterior limit of the mastoid process, but vary very much in the height at which they are found, some being quite high up on the skull, and others appearing even upon the base. To designate this position I have used the term *middle* when the external orifice of the foramen was about on the line of the meatus and middle of the mastoid; *low* when it is below this line and above the base of the skull; *high* when above this line.

No. 1. One on right, minute, middle.
Two on left, minute, middle.

No. 2. One on right, very large, on the base of skull.
One on left, minute, middle.

No. 3. One on right, large, middle.
One on left, minute, middle.

No. 4. Marked "deformed;" one on right, very large, low.
one on left, very large, low.

No. 5. One on right, medium, on edge of base.
One on left, medium, on edge of base.

No. 6. One on right, large, low.
One on left, enormous, low. No. 103, Museum.

No. 7. One on right, medium, middle.
One on left, medium, middle.

No. 8. Three on right, one large and two small, middle.
Three on left, two large and one small, middle.

No. 9. One on right with two openings externally, one large, one small, middle.
One on left, medium, middle.

No. 10. One on right with three external openings, medium, middle.
One on left, medium, very high.

No. 11. None on right, unless a minute one in suture, very high.
One on left, large, on edge of base.

No. 12. None on right, marked C. 1.
None on left.

No. 13. One on right, large, middle.
One on left, medium, middle.

No. 14. One on right, very large, middle.
One on left, medium, middle.

No. 15. One on right, large, middle.
One on left, large, middle.

No. 16. One on right, with two openings externally, large, middle.
One on left, medium, middle.

From this table it will be seen that in the 16 skulls examined, mastoid emissary foramina existed in all except 1. In the 32 temporal bones of these 16 skulls these foramina were present in 29. The size of the openings varied very much, being about 5 mm. in diameter in 1, 4 mm. in 4, 3 mm. in 10, 2 mm. in 10, and 0.5 mm. in 4. In regard to the position of the external opening, it was opposite the meatus about the middle of the perpendicular height of the mastoid in 20, above this line in 2, below this line in 6, and directly upon the base of the skull in 1.

A CASE OF INTRACRANIAL MYXO-SARCOMA, DESTROYING THE WHOLE OF THE ORGAN OF HEARING, BURSTING THROUGH THE EXTERNAL PARTS, AND FORMING A LARGE TUMOR WHICH DEPENDED FROM THE EAR.

By OREN D. POMEROY, M.D.,

NEW YORK.

Effie B. R., aged six years, came to the Manhattan Eye and Ear Hospital on April 17, 1880, complaining of a convergent squint in the left eye, which had existed ten weeks. A few days previous to the suddenly developing squint the patient complained of seeing double.

The eye is turned very far toward the nose, and hardly moves at all, as though the internus was in a state of spasm.

The hearing of the right ear was W. $\frac{24}{96}$; of the left, W. contact. In the right were symptoms of chronic catarrhal otitis media, the membrana being somewhat sunken. The left has a minute polypus in the tympanum protruding through a small perforation of the membrana. The tuning-fork is heard best in the left ear. There was no history of a suppurative process in either ear.

A consultation was called, and a diagnosis of malaria or basilar meningitis was made. Pulse and temperature normal.

Quinine was first administered in large doses; afterward iodide of potass. was given—ten drops of the saturated solution three times a day, increased after a few days to thirty drops.

Faradism was also used to the affected muscle. The granulation was removed from the ear by forceps. After the first week the patient complained of pain in the left eye and ear, glancing downward to the throat. Iodine on the temple, a blister to the mastoid, and atropine in the eye, relieved this pain for a time. Patient behaves somewhat too quiet; bowels constipated; sleeps

too much, and is only awakened when a paroxysm of pain in the eye occurs. In from eight to nine days the squint disappeared, but the third nerve was found to be completely paralyzed, the eye standing nearly still in the centre of the palpebral fissure, and the lid drooping so as nearly to close the eye. The inferior oblique acted. Pulse occasionally runs up to 130, but evidently under the influence of excitement, for the temperature was never above the normal. The pain in the eye again returning despite previous treatment, McMunn's elixir of opium was administered. If the patient is spoken to or in any way disturbed, she will cry out and show signs of great irritability. Ophthalmoscope reveals signs of hyperæmic nerve.

Iodide of potass. seems to render the mouth sore, so it is discontinued for a few days.

On May 26th noticed a little twitching of the hands and feet, more of the left than the right.

On the 27th the pulse, during a paroxysm of pain, was 130; twenty minutes afterward, when the pain subsided, it was only 84. The eye seems tender, although not congested at all, and she will scream out if it is touched. There was a little shaking of the left foot only. The mouth is for the first time drawn to the right side, and she talks a little "thick." The tongue is protruded toward the right. Respiration has all along been tested, and varies with the pulse, and probably for the same reason. The mind is, and always has been clear, and has continued so during the whole of the illness; will occasionally have periods of brightening up and appearing natural. Nourishment is carefully attended to, though she is disinclined to take much unless urged. On the 31st of May had no unpleasant symptoms except a darkish coating of lips and gums—probably the effects of the iodide of potass. Is inclined to pick at her mouth and nose.

June 1st.—Has return of pain in the eye, and the ear is noticed to have an offensive discharge. On examination, a soft gelatinous tumor was seen nearly filling the meatus. This was removed by forceps, but, the material being soft and friable, a specimen could not be obtained for examination. Some hemorrhage followed its removal.

June 2d.—Some nausea: lid does not droop so much as at first, on account of a more complete paralysis of the orbicularis.

Symptoms for the next few days were somewhat ameliorated, and on June 5th she was sent home to the country, a distance of seventy miles. Dr. Ruff, of New York, saw the patient several times with me. Carbolic acid was used for the offensive discharge from the ear, and iodide of potass. was ordered to be continued. Attention to the bowels, and to supporting by appropriate nourishment, was directed.

By this time there seemed little doubt but that the ear was the source of all the symptoms, and from the rapid reappearance of the aural tumor, malignant disease was strongly suspected. In the country the patient was under the care of the family physician, who attended to the symptoms as they arose. After a few weeks the ear again filled with a softish tumor similar to the one removed. This was followed soon after by a tumor just behind the lobulus, and another in front, just beneath the tragus. These tumors grew with most alarming rapidity, so that on August 15th, when she had returned to town, they were of the size depicted in the illustration (Plate I., Fig. 1), but considerably smaller than when the autopsy was made.

A photograph was attempted, but the patient could not be kept sufficiently still. The tumor now was here and there bloody, with spots which had undergone decomposition, and, it being warm weather, flies were constantly alighting on it and rendering the patient very restive; the tumor was extremely offensive. Dr. J. A. Andrews, Assistant Surgeon to the Manhattan Eye and Ear Hospital, made the drawing which appears in the illustration. Effort was made to hold the child's head still, in order to be photographed, but the patient would resist so that the strongest man could not restrain her movements, these being accompanied by loud and piercing cries distressing to listen to. The child was then taken home, with proper directions given for the symptoms which might arise.

I heard from the patient from time to time. The mind was always clear; evidently there was no brain trouble, unless the twitching of the hands and feet indicated it. Deglutition became more

and more difficult as the paralysis became more complete. There has been some pain about the back of the neck, in the region of the tumor. She usually has slept moderately well. The tumor was horribly offensive until toward the last, when the disinfectants (carbolic acid and liq. sod. chlo.) seemed to have overcome the stench (or perhaps there was less decomposed tissue). The tumor seemed to occasionally slough in places, when the size would be considerably diminished, to again be increased by subsequent growth. After death the mother states that the tumor was at least one-third smaller than just previously. Ten days before death the patient felt hungry, but found so much difficulty in swallowing that very little food was taken, and that would be placed on the right side of the mouth, the better to swallow it. Within a few days of death the patient had a bad cough, and inclined to choke during paroxysms of coughing. I inferred it was bronchitis. She evidently died from inanition and exhaustion. There was never any well-marked cachexia. She sank away quietly and painlessly, the pain having disappeared several weeks previous to death. There seems to be very little hereditary tendency to malignant disease in her family. Her great-aunt on the mother's side died of cancer of the uterus. The child fell down-stairs, from the top to the bottom, when seventeen months of age, but she apparently did not suffer much from it at the time. There was no syphilis in the family. It is difficult to state what caused the disease.

The autopsy shows that the two tolerably distinct tumors were outgrowths from the tympanal tumor, which was the first one observed.

The early development of the tumor was evidently from the neighborhood of the tympanum, as the first symptom of the disease was paralysis of the sixth nerve, then of the third, and soon afterward of the facial, these passing in the vicinity of its tympanal development. As the paralysis of certain muscles of deglutition did not occur until some time after that of the facial muscles, we may infer that the anterior portion of the facial in the hiatus fallopii, where the petrosal branches are given off from the intumescentia gangliformis, was invaded by the tumor somewhat later.

At this time, however, the disease had destroyed the inner bony

wall of the tympanum sufficiently to involve the region of the cavernous sinus along, within and beside which pass the sixth and third nerves, which were paralyzed in the first instance.

The intracranial tumor seen in the heliotype is slightly below life-size and distinctly lobulated, and has in only one or two places penetrated the dura mater. It would seem, by this and the other cases reported, that the dura mater was inclined to strongly resist the destructive influences of this form of tumor, although its tendency to involve every variety of contiguous tissue is well enough known.

The absence of brain-lesions seems to be a characteristic of the progress of this form of disease, although the brain must have been pressed upon strongly. The cases herewith reported, although variously called myxo-sarcoma, melano-sarcoma, osteo-sarcoma, round-celled sarcoma, fasciculated sarcoma, etc., seem in the main to exhibit similar characteristics, such as a disposition to grow more slowly at first and very rapidly afterward, when operative measures have been resorted to, and to develop into the soft, encephaloid form of disease, with the production of a fungous mass. Nothing seems clearer than that these tumors should be left alone, for the effort to remove them only aggravates, and produces a tumor of a higher degree of malignancy and having a greater tendency to cellular development. It seems improbable that purulent processes develop these tumors. Very naturally, with a strong tendency to malignant disease, any exciting cause might hasten its development.

Description of the Illustrations.

Plate II., Fig. 1, shows the tumor depending from the ear, but considerably smaller than at the autopsy. The distorted mouth and closed eyelid show the paralysis of the facial and motor oculi.

Plate II., Fig. 2, shows the outer surface of the temporal bone, with its periosteum intact. The transverse dark line is where the bone was sawn across and laid together again. At the left side (when the bone is looked at in its natural position) the mastoid process is seen denuded of periosteum, and the jagged under-surface shows the progress of bone-destruction. Fig. 3 exhibits the inner sur-

FIG. 1

FIG. 2

FIG. 3

FIG. 4

Plate II.

face of the same bone; the tumor rested on its surface, but was turned off to the right side to allow the bone to be inspected. In the upper part of the figure a whitish transverse stripe shows where the tumor was attached to the dura mater. The whole inner surface of the bone is seen to be carious, but more especially at the lower (*i.e.*, on the right side) jagged border. An oblique grayish band indicates the presence of osteophytes. The petrous portion is seen broken off and lying near its attachment. It is necessarily out of focus, and looks smoother than it actually was. Immersion in the preservative fluid has also diminished its honeycombed appearance. Plate II., Fig. 4, shows the cerebral tumor in situ and resting on the bone already described. The edge of the bone is seen distinctly above and to the right. A dark line at the apex of the tumor shows where it was cut into. The nodulations on the tumor are not plump and prominent as they were at first, as the solution in which it was immersed has undoubtedly caused a diminution in the fluid contents of the tumor. The accompanying figure in the text shows, by a dotted line, the outlines of the tumor at the base of the brain.

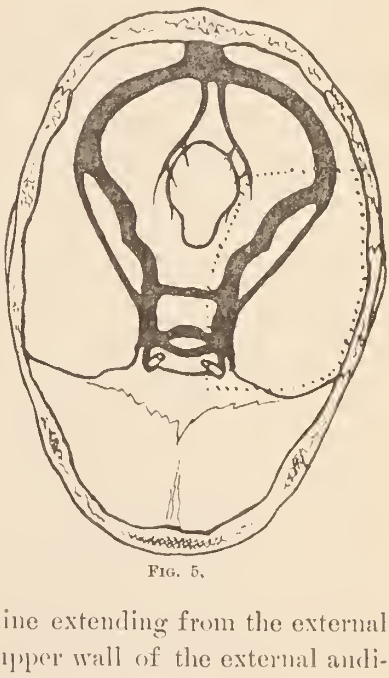

Fig. 5.

The autopsy was made by Dr. J. A. Andrews, who kindly went to the patient's house, a distance of seventy miles, in the country, for the purpose.

Autopsy, forty eight hours after death.—Body greatly emaciated; mouth drawn toward the right side. A large, brain-like growth is situated in the region of the left ear, which is bounded superiorly by a line extending from the external canthus of the left eyelids to the upper wall of the external auditory canal on the corresponding side. The growth is heart-shaped, with its apex directed downward, and measuring four inches

across the base and five inches in the vertical direction. The growth does not project through the external auditory canal, but through the point of attachment of the pinna to the head, in front and behind.

On removing the calvarium, the dura mater is seen pale, but otherwise normal in appearance. The superior longitudinal sinus contains a long, yellowish red, cord-like clot. The pia mater is lifted by a clear fluid. The convolutions of the brain over the vertex are of normal prominence. There is no exudation at the base of the brain. The removal of the brain displays a growth beneath the dura mater, and filling the left middle cranial fossa and a portion of the anterior and posterior fossæ. The dura mater overlying the growth is thickened and firmly adherent to the latter. The surface of the growth is nodular; one of the ball-like pedunculated projections of the tumor passes under the left anterior clinoid process, displacing the nerves and vessels in this region.

On incising the tumor it presents the appearance and consistence of fat, and is lobulated. The tumor envelopes the lower two-thirds of the petrous bone, which, on removal of the former, is seen carious in every part. The tumor is limited anteriorly by a horizontal line extending across the base of the skull, parallel with the optic foramina; laterally, by a line extending obliquely from the left optic foramen to the anterior condyloid foramen; behind, by a horizontal line touching the anterior condyloid foramen. The entire petrous bone is carious; anteriorly, the carious process extends just behind the temporal suture; the squamous portion of the temporal bone is separated by caries from its articulation with the spine and great wing of the sphenoid; through this gap the tumor projects outward upon the face; posteriorly, the caries extends beyond the temporo-occipital articulation to the margin of the foramen magnum. Behind the mastoid process there is a gap between the occipito-temporal articulation, formed by caries, through which that portion of the tumor situated behind the ear projects. The left superior petrosal and lateral sinuses have been obliterated, and the underlying bone is carious. The carotid canal and middle ear have also been obliterated.

The brain is macroscopically normal in appearance and consistence. The left lateral ventricle contains about ℥ ij. of clear fluid. The brain overlying the tumor is not softened.

The microscopical examination, together with the drawings illustrating the description, were made by Dr. T. Mitchell Prudden, Pathologist to the Manhattan Eye and Ear Hospital, etc.

The lobulated tumor which, after preservation in Müller's fluid and alcohol, measured about 8 ctm. in length, 6 ctm. in breadth, and 4 ctm. in thickness, was attached to the inside of the temporal bone, and covered above by the dura mater. It was for the most part soft and gelatinous in consistence, except in the central portions, where it was firmer and less translucent, and distinctly nodular. Within were several small, irregular cavities, some of them filled with blood. Several larger and smaller nodular projections from the upper surface of the tumor had pouched the dura mater upward in saccular dilatations, to which they were closely adherent. The dura was in general somewhat thickened, but over the apex of some of the nodules was thinned, and in two cases was completely perforated, closely encircling the nodules at their base. On the side toward the temporal bone was a ragged, pyramidal cavity, in which lay an eroded fragment of the petrous bone about 2 ctm. long by 1 ctm. wide. Along the inside of the temporal bone, following the upper margin of the tumor, and above the eroded opening, through which the portion of the tumor within was joined to that without the cranial cavity, was a broad line of jagged, irregular osteophytes.

The microscopical examination revealed in general the structure of myxo-sarcoma, similar to that of fragments removed, and sent to me for examination before death. The cells were fusiform, branching, and spheroidal or polyhedral, and in some parts were quite closely crowded together; in others more or less widely separated by structureless, granular, or delicately fibrillated intercellular substance. It was very vascular in many parts, and, in regions where the intercellular substance preponderated, the walls of the smaller vessels were considerably and irregularly pouched. Numerous larger and smaller nerves passed through the substance of the tumor, apparently entirely unchanged. In other places sin-

gle medullated nerve-fibres, or irregular bundles of the same, were seen closely surrounded by the new-growth.

At the upper and inner side of the tumor, and occupying about one-fourth of its bulk, was an irregular, indefinitely circumscribed and somewhat denser portion, which, in addition to the above described myxo-sarcomatous structure, presented well-defined spheroidal and pear-shaped ganglion-cells and non-medullated nerve-fibres, both single and in bundles. The ganglion-cells were finely granular, had large vesicular nuclei, and sharply defined shining nucleoli; they were frequently pigmented near the nucleus, and in many cases were directly connected with non-medullated nerve-fibres. They were, for the most part, inclosed in well-defined, thin, cellular capsules, and were closely surrounded by the tumor-tissue. They were, as a rule, smaller than the space within the capsule, and in some cases the nucleus was at the end of the cell from which the process passed off. The size was variable, the largest having a diameter of 0.035 mm., the smallest 0.015. They were, in many places, closely crowded together; in others, widely separated by the tumor-tissue. Everywhere among them non-medullated nerve-fibres were found in abundance. Plate III., Fig. 1, represents a typical portion of this region.

In some places, associated with these well-formed ganglion-cells, but, as a rule, apart from them, were scattered cells, or larger and smaller cell-groups, so peculiar as to deserve special notice. They were of various shapes, in general more or less spheroidal, more coarsely granular than the ganglion-cells, and, on the average, smaller. The largest measured 0.0375 mm., the smallest 0.0075 mm. They had an irregular-shaped, but usually large nucleus, and usually a well-defined, large nucleolus. In some cases, distinct narrow processes were seen passing off from one end of the cell, in others none. Many were devoid of capsules, but a large proportion were enclosed in a shrunken, apparently structureless non-nucleated capsule, which, in nearly all cases, was considerably larger than the cell itself. Among these cells numerous, very much elongated spindle-cells were seen with rod-like nuclei. A portion of the tumor in which these cells abounded is reproduced in Fig. 2 (Plate III.).

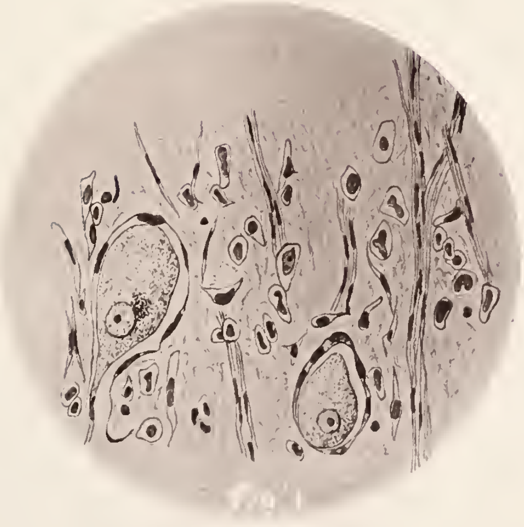

Plate III.

Although not closely conforming to what is known of developing ganglion-cells, it would seem not improbable that these represent such cells, either immature or imperfectly developed.

At one point on the surface of the tumor, near its inner border, a slightly pedunculated nodule about 4 mm. in diameter projected upward, and a small nerve passed down over one side and was lost in the nodule near its base (Plate III., Fig. 3). Sections embracing both nerve and tumor showed that the nerve entered the nodule, which had a structure similar to that of the bulk of the tumor, and the fibrés here became separated by the tumor-tissue, and passed off radially within it, where they were apparently lost, for none could be detected entering the main tumor through the short peduncle. This nodule was covered by a thin layer of connective tissue, apparently continuous with the sheath of the nerve. Transverse sections through the nerve before it joined the nodule showed nothing abnormal.

The fragment of the petrous bone presented the usual appearances of caries, except that the granulation-tissue in many parts partook more or less distinctly of the character of the tumor itself. No remnants of the structures of the internal ear were detected. The dura mater showed, at points where it was most closely adherent to the tumor, an infiltration of its inner layers with cells similar to those in the new-growth.

It is evident from the above description, and from the position of the tumor at the base of the brain, that it had involved the Gasserian ganglion, crowding the nerve-cells and fibres apart. Whether it originated here or in the connective tissue of some of the adjacent nerves, cannot be definitely decided from the morphological data, since the process was too far advanced. The very significant relation, however, of one of the peripheral, and presumably more recently developed, nodules of the tumor to a nerve (Fig. 3), the *bevelling on the inside* of the eroded opening through the temporal bone, with osteophytes along its inner border, together with the well-known disposition of the connective tissue of the nerves to the development of myxo-sarcoma, would at least give considerable plausibility to such a conjecture. The extensive destruction of the petrous bone would also indicate

the existence of a morbid process in its vicinity of considerable duration.

The degree of significance which should be attached to the cells represented in Fig. 2 must also be left undetermined. The rare occurrence of the new-formation of ganglion-cells in tumors, together with the meagreness of our knowledge concerning the development of cerebro-spinal ganglion-cells under normal conditions, would suggest the propriety of a simple objective record of the structures in question, without definitely attributing to any portion of the tumor the character of a true neuroma.

The *anatomical diagnosis* would accordingly be myxo-sarcoma, involving, and possibly originating in, the Gasserian ganglion and the nerves in its vicinity, with partial destruction of the petrous and other portions of the temporal bone and the soft parts within them.

The subjoined cases represent tumors similar in kind and locality to the one reported, and may serve to further elucidate the subject. I do not at all infer that the literature of the subject is exhausted; but, with the time at my disposal, it is all I have found.

Dr. C. A. Robertson reported a case of fasciculated sarcoma of the tympanum, in the "Transactions of the American Otological Society for 1870," p. 35. The patient was a woman, forty years of age. She had tinnitus in the affected ear, and deafness. Five years after these symptoms there was an offensive discharge. This was accompanied by pain in the ear and paralysis of some of the branches of the facial nerve. A polypus was partially removed, and excessive hemorrhage followed. The hearing became so reduced that a watch could not be heard laid on the ear or temporal bone. The pre-auricular glands were swollen. Termination of the tumor was not stated, nor its apparent cause.

Wilde, in his treatise on the ear, p. 205, reports a case of malignant disease of the meatus, but it evidently involved the tympanum—whether primarily or secondarily, it is difficult to state. A woman, aged fifty years, whose brother died of cancer, presented herself with a growth in the ear, of many years' duration, accompanied by a very fetid discharge. Had an unhealthy look; complained of giddiness, loss of rest, and nausea. The tumor filled

the meatus and was not pediculated; painful. Effort was made to remove it, but was followed by considerable hemorrhage. Cauteries were used, but the mass was never wholly removed. Showed an alarming tendency to reproduce itself. It presented a fungous appearance. A fluctuating tumor on the mastoid was opened, and a dark-colored, fetid matter was discharged. There was facial paralysis; abscesses along the mastoid muscles; rigors; failure of general health; convulsions followed by coma; excruciating pain. Post- and infra-aural regions enlarged; integuments of the mastoid gave way and a large fungoid mass sprouted from this region, which soon grew to the size of a lemon. Fetor intolerable; death resulted in three weeks from the first appearance of this tumor. Cause of disease probably hereditary. The malignant quality of this tumor was evidently aggravated by the efforts made to remove it. No autopsy.

Another similar case from the same source, p. 207. An apparently healthy boy, seven years of age, had a polypus in the meatus. It was removed several times, but would reproduce itself in a day or two; not long after he had an epileptic fit; this was soon followed by an abscess over the mastoid. This was evacuated, giving exit to pus; this cavity communicated with the meatus. A fungous mass almost immediately sprang from it; parts in front and around the ear became swollen and were boggy to the touch. Repeated attacks of epilepsy, soon followed by death. Autopsy revealed osteo-sarcoma involving the petrous and mastoid portions of the temporal bone. Petrous portion enlarged and softened. The whole presented a fungous mass; internal ear obliterated. The disease was thought to be located in the bone. Brain lying on the tumor unaffected. This again showed, as did my own case, the tendency of the tumor to take on a more rapid growth after being interfered with. Dr. Hartmann, of Berlin, in a translation by Dr. Knapp, in the *Archives of Otology* for March, 1880, reports a case of round-celled sarcoma of the tympanum, as follows: O. J., aged three and a half years, first seen in October, 1878. Parents, brothers, and sisters healthy. The patient otherwise healthy. Four weeks previously had discharge from the ear, accompanied by pain and inflammation. Two weeks later mother noticed a tumor

in the meatus; found to be a polypus of the size of a pea, which was removed. Others were noticed in the canal, which were subsequently partially removed, were cauterized, but returned in a few days. Nothing peculiar in the appearance of the tumors; membrana and ossicles could not be found. Tumor seemed to start from all sides of the tympanum and inner end of the meatus. Cauterization again done, but tumor reappeared. At the end of October most of the mass was again removed, and the remainder was destroyed by galvano-cautery. It again developed, and the surroundings of the ear, the parotid, the mastoid and infra-auricular regions swelled; an abscess formed below the ear and was incised. Its cavity communicated with the meatus. Other tumors formed in vicinity of the ear and in the meatus. These masses were found to be round-celled sarcomata. In the scant intercellular substance of the tumors were found numerous round cells and some spindle-shaped elements. The tumor, as it developed, carried the auricle outward. In February it was the size of a goose-egg. General health declined. There was bronchitis, loss of appetite, diarrhœa, emaciation, and headache.

On March 21st, bilateral convulsions occurred, lasting several hours, then completely disappeared. A prominence in the right side of the fauces interfered with mastication and deglutition. Death resulted on March 28th; convulsions reappeared two days previously, accompanied by loss of consciousness and coma.

Autopsy.—The tumor externally was 14 ctm. in length, 12 ctm. in breadth, and 9 ctm. in height. The auricle was on its crest. The tumor consisted of a number of lobes, varying in size from a walnut to a hen's egg. There were ulcerated places communicating with pus-cavities. The upper and posterior wall of the meatus, the roof of the tympanum, and a part of the squamous portion, was destroyed; at the latter point the external tumor communicated with another tumor in the cranial cavity. This one covered the whole squamous portion, the external half of the upper surface and a small part of the posterior surface of the petrous portion. The outer part of the mastoid process was destroyed, its cells being filled with the tumor. Inner part of mastoid was also invaded by the tumor. It was easy to separate the petrous pyra-

mid from the mastoid process. Labyrinth healthy, stapes found imbedded in the tumor. Inner auditory canal completely free. The author remarks that the fact that this case appeared malignant from the start presented a peculiarity, as most of this class of tumors was preceded by a chronic otorrhœa and polypi, indicating an inflammatory origin. It seems to me that the cases I have here reported for the most part point to the opposite condition—that they *have* been malignant from the first, and were not cases of innocenous polypi which had subsequently developed into malignant tumors. The first one quoted from Mr. Wilde, however, may have been in the outset an ordinary polypus. He further states that he has found but one similar case reported in literature, that published by Wishart in the *Edinburgh Medical and Surgical Journal*, and cited by Toynbee in his treatise on "The Diseases of the Ear," p. 392, edition 1868, by Hinton. The case is as follows: A child three years old had severe pain in the right ear for some weeks, followed by a discharge; a tumor surrounding the ear appeared, soon ulcerated, and discharged a large quantity of fetid, bloody matter; hemorrhages frequently occurred; child died in fifteen weeks after the first appearance of the disease. The tumor was as large as the child's head. Externally the condyloid process of the lower jaw and the zygomatic process were destroyed. Petrous bone completely destroyed. The tumor extended into a large orifice in the squamous bone, forming a depression on the middle lobe of the brain, which was in other respects quite sound. Dr. Hartman thinks the tumor he reported sprang from the submucosa of the tympanum.

He seemed to think that the effort to remove the tumor was justifiable, as this class of growths, if left to themselves, invariably terminate in death; because the operation afforded *some slight chance for success;* we think it probably did not.

Mr. James Hinton, in his book, "The Questions of Aural Surgery," London, 1874, says, under the head of Aural Polyps, p. 195: "Now and then, but rarely, a true malignant growth simulates a polypus, and demands caution in treatment. The general cachexia, the pain, the livid color, the great tendency to bleed, and the swelling which is almost always present around the ear, serve to dis-

tinguish the malignant growth. A soft, persistent swelling about the attachment of the auricle, attended with great pain, I have never known except in malignant disease." Wilde, it will be remembered, speaks of the livid color of the malignant growths in the ear as being characteristic.

I do not think that the color of the tumor is a reliable guide as to its nature, as these and subsequent cases will show, the true character of the growth being only found by the microscopical examination, but may be suspected by its behavior. Mr. Hinton speaks of a *cachexia* as accompanying malignant growths of the ear. In not more than two of the cases here reported has there been any true cachexia, and I believe, as a rule, none is found in sarcomatous tumors in this region.

A case of intracranial sarcoma is reported by J. W. Hulke, F.R.C.S., in the *Medical Times and Gazette*, January 20, 1877, which bears a close resemblance to the tumor I have reported.

Case.—J. W., a boot clicker, aged thirty-nine years. The tumor seemed to arise from the tip of the petrous bone; as the author thinks, from the endosteum. It had involved and destroyed the Gasserian ganglion, the third, fourth, and sixth nerves. Its direction was forward, extending to the posterior part of the orbit through the sphenoidal fissure, and involved the posterior part of the orbit and some adjacent parts. The cavernous sinus was destroyed, together with the eighth nerve and hypoglossal at the foramina of exit from the skull. No brain-symptoms. As the patient was syphilitic, a gummy tumor was diagnosticated during life. Hearing of the ear corresponding to the side of the tumor was not as good as the other. The eyeball was much inflamed, and protruded excessively from the orbit, on account of the retro-bulbar tumor. Pain very great. Paralysis of the muscles supplied by the nerves involved ensued, such as protruding the tongue to one side, squint, myosis, etc.

Dr. George P. Field, in the *Lancet* for December 8, 1877, reports a case of a sarcomatous tumor in connection with the auditory nerve, in which there was blindness and deafness. Patient was a woman aged twenty-nine years. Had brain-symptoms; was admitted to the hospital January 29, 1877, and died April 29, 1877. Dr. Mahomed made the autopsy. He found a tumor the size of a

Maltese orange attached to the posterior surface of the right petrous bone, just above the internal meatus. It resembled the cerebellum in appearance, and was of soft consistency, like brain-substance. It seemed to have its origin from the dura mater lining the internal meatus and unsheathing the auditory nerve. It was found to be a round-celled sarcoma of moderately rapid growth. The author reports it on account of its value as a rare lesion of the auditory nerve. When the specimen came under observation the symptoms were too far advanced for an exact diagnosis of its point of origin to be made. I have found two other cases of sarcoma of the auditory nerve, but their bearing on the present subject was somewhat indirect.

A case of fibro-sarcoma of the auditory nerve is reported in the *Archives of Ophthalmology and Otology*, New York, Vol. III., p. 135, by Arthur Boettcher, of Dorpat.

Prof. Moos, of Heidelberg, in the *Archives of Ophthalmology and Otology*, Vol. IV., 1874, p. 482, reports a case of sarcoma of the auditory nerve, in which there was fatty metamorphosis and partial destruction of the organ of Corti. The tumor was a spindle-celled sarcoma. The cells were very abundant, vessels were numerous and very broad, with the intercellular substance little developed. The tumor is described as being unequal—in one place harder and transparent, and in another gelatinous and soft, like mucus. Patient was a woman, aged forty-nine years. Duration of the disease was from August, 1870, to August 11, 1871. On July 24th the condition is summed up as follows: permanent headache, dizziness, weakness of sight, atactic movements of left arm (left ear was affected), anæsthesia of left half of the face, so that the food falls out of that side of the mouth; swallows her food the "wrong way," and fluids are regurgitated into the left nostril, rarely into the right. Left side of face and tongue and left eye less sensitive than right, although not quite anæsthetic. Left eye convergent strabismus. Left frontalis has a permanent tonic spasm. Lower lid of the left eye makes jerking movements toward the middle line. Left arm makes atactic movements, but only under impulses of the will. In sleep, and when attention is withdrawn from it, it lies quiet. Lower lip pendulous on left side.

August 1st.—Condition unchanged. Temperature remains steadily below 37.5° ; diarrhœa continued (previously had been a frequent symptom) ; patient growing weaker. On August 11th swallowed food the wrong way, fell back with a rattle in her throat, turned black in the face, and died in a few minutes. There were also eye-symptoms. He states that Landifort and Lévêque-Lasource have, among older authors, described this kind of tumor, and recently Brückner and Böttichcr have also reported them. Forster and Voltolini are also quoted. Virchow states that the acusticus presents new formations oftener than any other cerebral nerve. It is not stated whether the sheath of the acusticus was the starting-point of the disease, simply stating that the "peduncle of the tumor is formed by the auditory nerve." The facial nerve was free, having suffered only from compression. Causation of these tumors is here stated to be mechanical injuries (Brückner's case : "Beitrag zur pathol. Anatomie der Geschwülste im Verlauf der Nerven." Manitz, 18 4) and syphilis (Aronssohn : "Observations sur les tumeurs développées dans les nerfs." Strasbourg, 1822).

Virchow states mechanical injuries and syphilis as the cause of these tumors. The tumor here reported seemed to have been caused by sleeping all night by an open window. Moos, however, raises the question that the tumor might have been present before the exposure, but that the cold excited it to a more active development.

In one hundred cases of ear disease treated by Dr. Kirk-Duncansen, in the *Edinburgh Medical Journal*, March, 1878, one of malignant growth was noted occurring in purulent otitis media complicated with mucous polypi, long under treatment. The malignant growths distended the external auditory canal and implicated the auricle. They were very painful, recurred often after removal, and finally were fatal. It is not stated what variety of tumor this was, but it very likely was a sarcoma.

Dr. George T. Stevens, of Albany, in the *Archives of ~~Oph-~~ ~~thalmology and~~ Otology*, New York, July, 1879, p. 171, reports a case of spindle-celled sarcoma of the acoustic nerve. The location of the tumor on the nerve is not stated, but the nerve-fibres are described as lost in the substance of the tumor. Patient

was a girl, seventeen years of age. Her eyes were affected with a marked convergent squint, but previous to the age of six she had a divergent squint. Externi were paralyzed; sight $\frac{20}{70}$ in each, pupils sluggish. Hearing lost in the left ear and imperfect in the right. Both eyes had choked disks. Headache in frontal and occipital regions; signs of meningitis; no paralysis of the facial, although it must have been pressed upon. From the time of the first appearance of the squint until death was several years. Her gait toward the last showed a lack of co-ordination, and a diagnosis of trouble at the base of the brain was made previous to the autopsy.

In the *Archives of Otology*, Vol. VIII., No. 4, is a case of parotidian and intratympanic tumor, reported by Dr. Knapp, which may properly be mentioned here. The patient was under the care of Drs. Knapp, H. B. Sands, and A. H. Buck, of New York, and Drs. S. H. Peck and S. J. Parker, of Ithaca, N. Y.

J. H. W., aged 37 years, consulted Dr. K. on May 7, 1877, on account of sudden deafness in the right ear. Below and in front of this ear was a tumor the size of a hen's egg, which the patient first noticed six or seven years previously. Had grown slowly until the last six months, when it took on a more rapid growth. Left ear, chronic painless otorrhœa. Right ear suddenly became deaf three days before consulting the doctor.

The membrane was bluish red, convex, and, on pressure with a probe, yielded as though a soft substance were in the tympanum. The membrana was punctured with a paracentesis-needle on May 8th; penetrated a tumor, which resulted in considerable hemorrhage. Tumor was touched with a probe, and seemed to be a soft, fleshy mass. The parotidean tumor was thought to connect with the tympanal tumor through the Glaserian fissure.

May 23d.—Great pain in the ear for a day and a night. Aural tumor found to occupy inner half of meatus. The latter was red, swollen, and tender.

May 29th.—Pain relieved. An abscess had formed, and pus escaped on pressing the tragus.

June 20th.—No more inflammation; tumor fills the meatus. Dr. K. having to go to Europe, Dr. Buck took charge of the case.

Dr. Sands removed the tumor of the parotid on June 26th. It was found to have no connection with the aural tumor. The latter was also partially removed at the same sitting, with Dr. Buck's assistance.

July 24th.—Returned to his home nearly well. Dr. Buck states that the external tumor was chiefly fibrous, but partly cartilaginous and cellular.

July 28th.—Incision for removal of parotid tumor healed; pain in ear continues, and aural tumor increased perceptibly in size; was mostly removed by incision, and was followed by considerable hemorrhage. Other efforts were made to remove the remainder, but so much bleeding resulted that the meatus needed to be stopped with cotton to arrest it. This tumor resembled boiled sago, and had no fibrous elements in its composition, as was the case in the tumor I removed from the meatus.

Microscopic examination by Dr. W. H. Porter, of New York. A detailed description is given, the conclusion of which is that both the parotidean and aural tumors were essentially a chondro-sarcoma (alveolar), or a chondro-adenoma, or chondro-carcinoma. Dr. Buck's description would make it a chondro-adenoma. On the same day another effort was made to remove the growth, but hemorrhage again interrupted the operation.

July 26th.—Red-hot needles were used to arrest the bleeding, but on the rongeur being again used, the bleeding returned; soon after this an abscess formed below the mastoid. Patient in a few days returned to Ithaca, and was treated by Dr. Peck, who records as follows:

August 14th.—Patient fatigued by his journey home; much pain; an indurated tumor below the auricle made its appearance and carried the ear outward.

October 25th.—Consultation by Drs. Knapp, Peck, Sands, and Buck. Tumor below auricle increased in size; meatus filled with a tumor having fistulous openings discharging pus; facial paralysis since five days. Decided not to operate; hoped it might slough and exfoliate, and thus be cured. Returned home. Tumor continued to grow. It assumed a very similar appearance to the tumor I have reported, and the patient died from exhaustion on

September 15, 1878, fifteen months after the first operation. The tumor measured seven inches, eight inches, and five inches in its three diameters. The ear rested on the outer surface of the tumor. There was no mental disturbance.

Dr. Knapp remarked that the connection between the two tumors may be assumed, but in the primary stage at least was not proven. Dr. Buck stated that the parotid was not involved in the growth. Dr. Knapp is in favor of attempting the removal of growths of this nature from the tympanum and immediate vicinity. He refers to Schwartze, in his paper on a primary epithelial cancer of the middle ear, in the ninth volume of the *Archiv für Ohrenheilkunde*, p. 208, etc., 1875; and in his "Pathological Anatomy of the Ear," translated by J. O. Greene, p. 29, etc., 1879, for the literature of the subject, compiled by Schwartze and comprising nineteen cases, to which is added a case of primary epithelial cancer of the petrous bone, by Lucæ (*Archiv für Ohrenheilkunde*, XIV., p. 127), 1878, and the case of Delstanche (*Archiv für Ohrenheilkunde*, XV., p. 21), 1879.

Dr. Harlan, in the *Philadelphia Medical Times* for December, 1873, reports a case of round-celled sarcoma in the ear of a girl three years of age. Two months before examination she had a bloody discharge from the left ear, with pain on swallowing, swelling about the ear, the face being drawn to the right. Appetite failed, and the child became feeble. Meatus externus was filled by a firm, globular polypus. There was a fluctuating swelling below and behind the auricle. Removal of the polypus and an incision behind the ear resulted in a discharge of sanious pus; no dead bone was detected. Left side of the face much swollen, as well as the left side of the tongue. Left eye became closed, but was unaffected by the exposure; pupil normal. Polypus was twice removed subsequently. Twenty-eight days after the first examination the tumor was the size of a hen's egg, bright red, lobulated, and having a granular surface. Subsequently the upper lid of the left eye almost covered the eye; the conjunctiva became congested, the cornea hazy, and the lower fourth infiltrated; free sanious discharge from the right nostril. Seventeen days later, the cornea was penetrated by an ulcer which pro-

duced prolapsus iritis. Breathing through the mouth and nostril had become laborious.

In a week from this she died, apparently from exhaustion.

Double convergent strabismus appeared some time before death, but nearly disappeared at a later period.

On autopsy, the bone at the base of the tumor behind the ear was found roughened and eroded. Inner tympanic wall destroyed. Inflammation of the eye was regarded as neuro-paralytic.

I had thought the case reported by me to be exceedingly rare, this being the only one of the kind occurring in the Manhattan Eye and Ear Hospital for nearly a dozen years; but I find, on investigation, although it is comparatively rare, it is not absolutely so.

FOUR CASES OF OTOMYCOSIS ASPERGILLINA SUCCESSFULLY TREATED BY THE INSUFFLATION OF OXIDE OF ZINC AND BORACIC ACID.

By SAMUEL THEOBALD, M.D.,

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In selecting an agent for the destruction of fungi in the human ear—more especially the frequently met with aspergillus—an important point is gained if we can find one that will not only eradicate the parasite, but will at the same time exert a beneficial influence upon the inflammation of the tympanal membrane and auditory canal which usually accompanies this condition. Alcohol, the remedy most commonly employed for this purpose, if diluted with water, is not, according to my experience, a trustworthy parasiticide, and if used in its anhydrous state is not always well borne, sometimes causing considerable irritation, and aggravating rather than benefiting the attendant inflammation.

For a long time I have been much given to employing oxide of zinc (usually in powder, though sometimes rubbed up with vaseline, with the addition of a little balsam of Peru) in the treatment of the chronic and subacute forms of diffuse inflammation of the auditory canal, especially in those moist inflammations attended by slight discharge, without perforation of the membrane, which I have met with oftenest in scrofulous subjects. More recently I have used, under similar circumstances and with still better effect, a powder containing equal parts of oxide of zinc and finely pulverized boracic acid. The knowledge which I possessed of its value in these cases, rather than any special convictions regarding its efficacy as a destroyer of parasitic growths, induced me to make use of this mixture not long since in a case of inflammation of the drum-head and inner extremity of the canal, due to the presence of aspergillus. The result of this experiment was so extremely

satisfactory, and its repetition upon three occasions recently attended with such excellent effect, that I have thought my experience in this direction, though as yet limited, worth recording.

In each instance the method of treatment was the same: the ear was freed of all discharge, and, so far as possible, of every bit of the fungus, by means of the syringe and probe, and then, having been wiped not too dry, the inner portion of the canal was filled, by means of an insufflator, with the zinc and boracic acid mixture. In two of the cases the additional precaution was taken of closing the ear with borated cotton after the application of the powder. The first case in which the treatment was tried was that of a young lady who had been under my care with recurrent furuncles in the external auditory meatus, and for whom I had directed vaseline to be applied to the orifice of the canal, to allay the itching which had followed the subsidence of the inflammation. Prior to this she had been instilling oleaginous drops (baume tranquille), in connection with which, however, I had prescribed frequent syringing. After using the vaseline for two weeks, she came to me complaining of some pain in the left ear and of slight discharge from it. (The vaseline had been applied to both ears, and so had the baume tranquille previously.) Upon examination the inner extremity of the canal was found to be covered with aspergillus, and when this was removed, marked congestion of the tympanal membrane and of the meatus-walls was revealed. After careful syringing the boracic acid and zinc mixture was applied in the manner described. This single application was followed by the eradication of the fungus and the relief of the inflammation. When next seen, four days subsequently, nothing having been done to the ear in the meantime, she reported having had no return of the pain or discharge; the ear was found to be quite dry, and no trace of the aspergillus could be discovered. A portion of the powder, which had formed into a lump, was rolled out with a probe; and subsequently the rest of it, which adhered to the membrane and the sides of the meatus, was removed with the probe and syringe. The case remained under observation for two months, and there was no return of the aspergillus.

The appearance of the aspergillus after the use of the vaseline

and the baume tranquille is worthy of remark. I am inclined to think that some of the latter was left in the inner extremity of the meatus in spite of the syringing, and that this, rather than the vaseline, was responsible for the development of the fungus. However, under similar circumstances, I should now add boracic acid to the vaseline, as it renders it more efficacious, and, as I believe, does away with all danger of its becoming a nidus for the development of the aspergillus-spores.

In the next case in which I had the opportunity of testing the boracic acid and zinc, its action was not less satisfactory. G. N., a fireman on board a steamboat, came to me with one ear completely blocked up with a mass of aspergillus. He had suffered no pain, but complained only of itching. After clearing out the ear as thoroughly as possible, the powder was freely applied, and the meatus plugged with a bit of borated cotton. The patient was not able to see me for a week, but during this time the cotton remained in position. Upon removing it the ear was found coated with the powder, and the aspergillus had entirely disappeared. Four months have since elapsed, and the fungus has not returned. The removal of the adherent powder was left to nature—the outgrowth of the epidermis of the drum-head and meatus-walls accomplishing this in due time more perfectly than I could have done.

The third case was that of a man employed in one of the railway grain-elevators of this city, who consulted me in November last for slight deafness of twelve months' duration, which a short time previously had become complicated by the appearance of a discharge from each ear, accompanied by soreness and itching. The deafness was found to be due to chronic middle-ear catarrh, and the other symptoms were accounted for by the discovery of aspergillus, in an early stage of development, coating the fundus of each ear. After careful use of the syringe and probe, which showed the tympanal membranes and inner portion of the canals to be much congested, the powder was applied as usual. At the end of a week the ears were again examined: the right one had given him no annoyance, was perfectly dry, and in it I could discover no remains of the aspergillus; in the left ear, however,

there was still some discharge, and it was evident that the eradication of the fungus had not been complete. This one was again syringed, therefore, and the powder applied as before. After this both ears remained dry, and the aspergillus did not reappear.

The powder which adhered to the drum-heads and the walls of the canals was not syringed out, and as the patient has remained under treatment for his middle-ear catarrh, and has visited me once a week up to the present time, I have watched with much interest its gradual transportation to the orifice of the meatus, through the outgrowth of the epidermis. When last examined, but two or three small particles, just within the orifice of each canal, were all that remained of the powder which had been applied to the right ear eleven, and to the left ear ten weeks previously. *In this time, therefore—from ten to eleven weeks—the epithelium from the central portion of the tympanal membrane had accomplished its journey to the outer extremity of the meatus.*

The last case came into my hands but a short time since, and is still under observation. A girl, fourteen years old, of Irish parentage and correspondingly dirty personage, was brought to the Baltimore Charity Eye and Ear Dispensary with this history: from the left ear there had been a nearly constant discharge of purulent matter for eight or ten years, unattended by pain. In the right ear she had had recurrent attacks of severe earache, every month or two, for a period of two years, for which sweet oil and laudanum, and sweet oil and black pepper had been applied from time to time. From this ear there was said never to have been any discharge. A recurrence of one of these attacks had induced her to come to the dispensary for advice, the pain during the previous night having been very severe. Upon looking into the right ear, several large and well-ripened heads of aspergillus were discovered springing from a whitish mass which filled the inner half of the canal, and which proved upon subsequent microscopic examination to be composed of mycelial rootlets and filaments; the heads showed the characteristic features of A. nigricans. In the other ear extensive destruction of the drum-head was found, with the usual appearances that accompany chronic otorrhœa, and with no evidences of the presence of aspergillus. After careful re-

moval of the fungus the zinc and boracic acid was freely applied to the right ear, and retained by the insertion of a piece of borated cotton. This application was followed by the disappearance of all pain; but three days afterward, upon removing some of the powder with a probe, I discovered what seemed to be a remnant of the mycelial web, and finding some moisture beneath it, I again syringed the ear and applied the powder as before. Several weeks have elapsed since this last application, and as no trace of the fungus can now be discovered, and the ear has remained perfectly dry and free from all symptoms of irritation, I think we may safely conclude that the parasite, which it seems probable had found an abiding-place in the auditory canal of this girl for the space of two years, has been effectually eradicated.

I have mentioned that I was induced to employ the boracic acid and oxide of zinc powder in the treatment of otomycosis, by my experience of its usefulness in diffuse inflammation of the external auditory canal, rather than by any definite knowledge which I possessed as to its influence upon the vitality of aspergillus. In order, therefore, to ascertain whether it was capable of exerting a specific control over the development of fungi, or whether the good effects which I had obtained from it were due simply to its drying up the exudations from the inflamed meatus, and thus starving out, so to speak, the aspergillus, the following experiment was tried: four pieces of fresh horse-dung, one of which had been sprayed with a warm saturated solution of boracic acid, and then dusted with the finely powdered acid, and another sprinkled with oxide of zinc, were placed together under a glass bell, and kept in a warm room so as to promote the development of fungi upon them. The result obtained was very striking. In two days a luxuriant growth of pilobolus made its appearance upon the two pieces which had had nothing applied to them, and a somewhat less vigorous growth upon the one which had been dusted with zinc. The borated piece, however, remained entirely bare. On the third day one of the plain pieces, which was then covered with the rapidly growing fungus, was carefully sprayed and sprinkled with the boracic acid. In a few days the growth upon the unborated pieces increased greatly, especially upon the one which had not been dusted with zinc, and

fruit-stalks, bearing myriads of spores, developed upon each of them. In the meantime, the originally borated piece remained, to all appearances, exactly as when first placed under the glass, and the fungus upon the other, which had succumbed to the treatment it received, showed no signs of revival. On the tenth day, at several points upon the second borated piece, the fungus began to show some vitality. It grew but little, however, and though watched for ten days after this, made no appreciable progress toward maturity. The piece first borated showed no growth upon it until the fifteenth day, when a single small tuft, scarcely larger than a pin's head, made its appearance. Three days afterward this growth, which presented the appearance of penicillium, the hardihood of which is proverbial, was removed for microscopic examination, but was not identified with certainty, owing to its undeveloped state. Though kept under observation until the twentieth day, there appeared upon this borated piece no other growth whatever.

While this experiment was in progress the last described case of aspergillus fell into my hands, and it occurred to me that, if I could cultivate the aural fungus after removing it from the ear, I might make a test which would be still more to the point. With this end in view, I preserved the pieces of the fungus (chiefly bits of mycelial web, with here and there a fruit-stalk) as they were removed, and, having kept them in water overnight, placed them the next morning in a wide-mouthed vial, upon a piece of white flannel soaked in rancid olive-oil. The vial was then corked, put in a box to exclude the light, and set upon the mantel-piece, where it would be kept warm by the heat of the chimney. In twenty-four hours each of the four pieces which had been transplanted began to grow, and in another twenty-four hours dozens of fruit stalks with fully formed heads (of a rich brown color at first, afterward becoming black) had developed upon them. Rootlets could be seen extending out in every direction into the flannel, and in forty-eight hours more the flannel was dotted all over with fruit-bearing stalks. Boracic acid was now applied in powder and solution, and by tilting the vial all but one group of the aspergillus was kept for several hours immersed in a warm solution containing an excess of the acid. The water was then removed, leaving the fungus and the flannel

about it crusted over with the acid. The effect of this was to permanently arrest all growth in the aspergillus which had been subjected to the action of the acid, while that which had been kept from contact with it (the flannel being soaked with oil prevented the solution being carried to it by capillary attraction) continued to grow for some days.

These experiments indicate clearly, I think, that at least one of the ingredients of the powder which I had employed—the boracic acid—does in fact possess the property of destroying the vitality of certain fungi. The other ingredient, the oxide of zinc, probably exerts no such specific influence; nevertheless, in the treatment of otomycosis, it serves, I think, in connection with the boracic acid, an important purpose, and I am disposed to attribute to its action in no small degree the good results of the treatment in the cases I have related, for not only is its influence upon the inflammation of the ear most beneficial, but by drying up the discharge it renders the survival of the fungus more difficult, and prevents the boracic acid from being diluted and washed out of the meatus. I may add that in one instance, before I began to employ boracic acid, I succeeded in curing a case of otomycosis by the repeated application of oxide of zinc alone, and that in another instance, in which I employed the boracic acid alone, the result was not so favorable as in the cases I have related, considerable pain following the second application of the acid, and not being relieved until the cotton with which the meatus had been closed was removed, permitting a considerable quantity of thin discharge to escape.

A CASE OF DEATH FROM CROUPOUS INFLAMMATION OF THE MIDDLE EAR, WITH ACUTE LEPTO-MENINGITIS OF THE CONVEXITY.

By E. G. LORING, M.D.,
NEW YORK.

In April, 1878, Mr. J. L. M. consulted me for a failure in his hearing. The patient was a middle-aged man, with a florid complexion, and of what is known as a full habit. He was, however, very temperate in all his habits, and took a great deal of exercise in the open air. For a month or two before consulting me he had suffered from a protracted and intractable cold in the head, with a slight bronchial complication.

The examination showed that the reduction in hearing was due to closure of the Eustachian tubes. This yielded readily to treatment, and there was no recurrence of the trouble until the month of December of the same year, when another attack ensued, which again yielded readily to treatment. A year later, however, the patient again returned with precisely the same complaint in regard to his hearing. There was no pain, nor were there any signs whatever of acute inflammation. The drum-heads were not injected, though there was what appeared to be a slight sinking, especially on the right side. Inflation with Politzer invariably gave relief for the time-being, but the trouble as invariably returned, and the patient was under supervision during the months of January and February, 1880. On the first of March of the same year, however, the trouble seemed to have left him entirely, and he ceased his visits. During all this time his general health had been even better than usual, and besides attending to his business he had walked, on the average, between five and six miles a day.

On the 13th of April he came to my office with the complaint that he had had a terrible night of pain. That the pain had not

been confined to his ear, but that the whole right side of his head had ached fearfully, and that at times the pain extended to the top of his head and to the entire frontal region. The examination now showed that the right drum-head was intensely congested, but was not much swollen; nor did it bulge forward or show any signs of fluid behind it.

At the time of the visit the pain had to a great degree subsided, and there did not appear to be any undue sensitiveness to percussion over and about the mastoid. The deafness on this (right) side was so great that he did not hear the watch except in contact. His pulse was normal, and there were no febrile signs of any description. The physical signs were those of commencing middle-ear trouble on the right side. The left ear presented a normal appearance in every respect.

The patient was sent home and three leeches were applied immediately. One was placed behind the ear, one just in front of the tragus, and one just within the meatus externus. I saw the patient that evening, and he informed me that the leeching had given him the greatest relief; that his headache had entirely gone; that the leecher had had a great deal of difficulty in stopping the blood, but that he did not feel at all weakened, but relieved by its loss.

When I called the next morning the patient informed me that he had had a perfectly comfortable night; had slept straight through until a few moments before my arrival. He was dressed, but lying on the lounge. There was not a particle of constitutional disturbance either as to pulse or temperature. There was no pain in the head or ear, and the patient seemed to be in the best of spirits, and, with the exception of his local trouble, in the best of health.

As considerable styptic cotton had been used in stopping the bleeding, and as this had become firmly matted down with blood, I proceeded to remove it. As it was difficult to do this, and as the patient was fearful lest the bleeding should start again, I ordered him to soak the cotton from time to time with hot water, and that I would return again in a few hours and remove the cotton.

Three hours later, or at twelve o'clock, a member of the family came to my office and informed me that the patient, shortly after

my leaving, had begun to have a feeling of distress about his head, and a general discomfort, but that there was no pain in the ear itself. They had sent for the family physician, who had reported that there was no febrile symptom whatever, and that the temperature was normal by the thermometer; that a quieting draught had been administered, and the messenger had called to say that it had been suggested by the family physician that the patient had better get some rest, and that therefore it would be better for me to postpone my visit for a few hours.

On returning to my office at five o'clock in the afternoon, I found an urgent request that I should come to see the patient the moment I returned. I went immediately to the house, and found the patient in bed. His wife informed me that up to two o'clock he had been comparatively comfortable, only complaining a little of a full and distended sensation of the head; that about three o'clock violent pain set in in the head, and the patient rapidly became very delirious, and that he had been growing worse ever since; that she had sent for his family physician and then for me, and that the patient had been as I saw him for the past hour, only more violent, as there were times when she had to use all her strength to keep him in bed. At this time the patient was throwing himself from side to side, not violently, but continually, and making occasional efforts to carry his hands to his head. He was unconscious, while his breathing was labored, though not stertorous, and there was no paralysis. The face was, however, livid, and the pulsation in the jugulars very marked. The pupils were moderately dilated, and there was no paralysis of the ocular muscles.

With the assistance of Dr. Asch, I managed to remove the plug of cotton and clotted blood which closed the orifice of the external canal, and got a good view of the drum-head. This was much less injected than on the previous day. There was, however, a slight bulging of the membrane at the lower part, and it was decided, with the approval of Dr. Asch and Dr. Roosa, to puncture the membrane, and a large free opening was made with the hope that if there was any contained fluid it would be evacuated. As no fluid appeared, however, a small piece of rubber tubing was accurately fitted to the meatus and suction applied, with no bet-

ter result. There was evidently no secretion in the tympanic cavity.

As the family physician, Dr. Belcher, had now arrived, the case was, with the wish of the patient's wife, handed over to him. At this time, in spite of all efforts, the patient was rapidly sinking, and finally died in less than an hour.

The result of the autopsy, made by Dr. W. H. Welch, is given below, in his own words:

Autopsy about twenty hours after death.—The weather was rather warm, and the body had not been on ice. Corpulent individual.

The thoracic and abdominal viscera, although somewhat decomposed, particularly the liver and kidneys, present no essential changes. The spleen, although soft, is not swollen. There are a few atheromatous patches upon the arch of the aorta.

The lateral, superior petrosal, and other sinuses of the dura mater contain some fluid blood and loose, reddish coagula, but no ante-mortem thrombi. The dura mater appears normal except in one situation. That part of the dura mater which covers the bony roof of the tympanic cavity and the adjacent portion of bone on the right side, is deeply congested, and presents numerous small, red points, which represent punctate hemorrhages. No similar appearances are evident elsewhere on the dura mater, noticeably none upon the corresponding situation of the opposite side. There is no free exudation upon the congested patch of dura mater. The portion of bone which forms the tegmen tympani of the right side is extremely thin and translucent; through it a bluish red color belonging to the contents of the tympanic cavity can be seen. The bone, although thin, does not appear carious or in any way diseased.

The small vessels of the pia mater are congested. There is a yellowish, sero-purulent exudation, moderate in amount, in the subarachnoid space and meshes of the pia mater covering the convexity of the cerebral hemispheres. This exudation extends from the longitudinal fissure down upon the sides of the brain, being rather more abundant upon the left than upon the right side. It is not present in appreciable amount upon the base of the brain. There

is a thick patch of yellow, creamy exudation upon the upper surface of the right lobe of the cerebellum near its anterior and lateral borders. Upon the rest of the cerebellum the exudation is only slight in amount. The substance of the brain appears normal.

The right temporal bone and adnexa are so removed that the specimen contains a part of the external auditory passage, the middle and internal compartments of the ear, the mastoid cells, and the osseous and cartilaginous portions of the Eustachian tube.

There is no abnormity to be noticed in the external auditory canal, with the exception of some clotted blood. Upon removing carefully the thin bony roof of the tympanic cavity, the mucous membrane of the middle ear is found swollen, softened, of a bluish red color, and coated in many places with a reddish gray, opaque, false membrane averaging about one millimetre in thickness. This pseudo-membrane can be readily stripped off from the subjacent mucous membrane. Punctate ecchymoses can be seen in the swollen mucous membrane, but there are no coagula of blood in the cavity of the tympanum. The swelling and exudation are more marked upon certain parts of the mucous membrane than upon others, most marked upon the membrane covering the tegmen tympani, promontory and entrance of the Eustachian tube, least evident upon the inner surface of the tympanic membrane. The tumefaction and exudation extend for a short distance into the mastoid cells. A small opening in the tympanic membrane can, with difficulty, be recognized. (This was made by the attending surgeon shortly before death.) The mucous membrane of the Eustachian tube appears somewhat congested and swollen, but presents no exudation except in its osseous portion, into which the membranous exudation extends for a short distance from the middle ear. The ossicles are freely movable and appear normal. The labyrinth, internal auditory canal, Fallopian canal and its contents, and the auditory nerve, present no abnormalities.

Microscopical examination.—The exudation upon the mucous membrane of the middle ear, examined fresh, is found to consist of fibrillated fibrin, many pus-cells, some ciliated epithelial cells, granular material, and red blood-corpuscles. The red corpuscles are in some places numerous and in others few or absent. The

fibrin is present quite independently of the red corpuscles. Some irregular, branching, homogeneous bodies and peculiarly metamorphosed epithelial cells, resembling those depicted by Wagner and by Weigert in croupous and in diphtheritic membranes, and attributed by the latter to coagulation-necrosis, can be isolated. The granular material in part presents the microchemical characters of micrococci, resisting the action of strong acids and alkalies. Many of the little granular bodies, when treated by Koch's method, stain deeply with methyl-violet. In some places zoöglœa or colonies of micrococci, with their characteristic appearance and reactions, can be distinguished. While these sphæro-bacteria or micrococci are very numerous, there are very few examples of bacterium termo (decomposition bacteria) to be recognized in the ear, although they are present in portions of the liver and kidneys. Transverse sections of the mucous membrane, stripped from the labyrinthine wall of the tympanum and hardened in Müller's fluid, show overfilling of the blood-vessels, extravasated red blood-corpuscles, many emigrant white corpuscles, especially in the upper layers, and some granular material. No fibrillated fibrin is present in the tissue of the mucous membrane. The epithelial cells are for the most part desquamated. The sections stain well in hæmatoxylin, and present no evidences of coagulation-necrosis below the epithelium.

There is no fibrinous exudation in the pharynx, fauces, or air-passages.

Diagnosis.—Otitis media crouposa with consecutive (?) leptomeningitis. WILLIAM H. WELCH.

The three following cases of secondary meningitis, without disease of the bone, are to be found in an article by H. Wendt, *Archiv der Heilkunde*, Bd. II, p. 595.

CASE I.—Merchant, forty-nine years old, of good constitution and previously well, consulted Wendt on March 13, 1869, for pain and buzzing sensation in left ear, which had begun eight days previously, and were attributed to catching cold. The symptoms had continued uninterruptedly.

Wendt found the right ear normal. The ticking of a watch could be heard by the left ear only when the watch was pressed against the pinna, and then only faintly. Chronic nasal and pharyngeal catarrh. The patient

experienced some improvement after blowing in air. Blood was withdrawn behind and under the ear. The nasal douche was employed. An incision made into the drum failed to cause any exudation to escape, except a very little mucus. Upon March 30th the patient was found unconscious in bed, with stertorous respiration, and died a few hours afterward, after having had repeated convulsions. The autopsy showed the Eustachian tube to be pervious—it contained a little mucous secretion; the external auditory passage was normal; the drum thickened, *the tegmen tympani thin* and easily removed; the dura covering it normal; the tympanic cavity was filled with viscid mucus; the mucous membrane reddened, swollen, and of soft, succulent consistence; the mucous membrane of the mastoid cells was in a similar condition; labyrinth and Fallopian canal normal. Basilar meningitis.

Case II.—Night watchman, fifty-two years old. After exposure to cold, developed catarrhal inflammation of the right middle ear, with perforation of the drum. There was pain and buzzing in right ear. The patient came under treatment on February 20th. There does not seem to have been anything noticeable about the case. Wendt was therefore much surprised to learn that on March 10th the patient was found dead in bed, having eaten a hearty supper the previous evening.

Autopsy showed diffuse meningitis of the entire surface of the brain, thick mucus in the tympanic cavity, perforation of the drum; bone normal; the *dura mater over the tegmen tympani of right side greatly congested.*

Case III.—Wendt relates a case of traumatic inflammation of the middle ear, following the entrance of a currant-seed pushed through the tympanum into the middle ear by unskilful attempts at removal. Basilar meningitis without perforation or disease of the bone followed. The dura mater in the middle fossa of skull on side of disease of ear was hyperæmic.

CLINICAL OBSERVATIONS.

VICARIOUS MENSTRUATION FROM A SEBACEOUS TUMOR OF THE MEATUS—HERPES ZOSTER—CYSTIC TUMOR OF MEATUS—THE CURE OF OTORRHŒAS IN PHTHISICAL PATIENTS.

By J. ORNE GREEN, M.D.,

BOSTON, MASS.

In November, 1877, I was consulted by Miss B., aged nineteen years, of slight figure, but perfectly healthy, for an occasional bleeding from the right ear. Six months before, without previous trouble of any kind with the ears, she had what she called an abscess in the right ear, from which she recovered in a few days; three months after there was a repetition of the same thing, in the same ear, followed by perfect and rapid recovery. From questioning I was satisfied that both attacks were slight furuncular inflammations of the meatus. During the summer she had had whooping-cough, with perfect recovery. Several weeks before I saw her, without known cause, there was bleeding from the right meatus for a short time, and this had been repeated a number of times. There was no pain, deafness, nor noises, and examination showed both ears absolutely normal in every respect, with the exception of a very slight prominence just at the edge of the right meatus, which I referred to a little thickening left from the last furuncle.

As there was considerable semifluid cerumen in the meatus I thought the so-called bleeding was probably reddish discoloration from this secretion, and simply quieted the patient's fears by assurances that the trouble was unimportant.

I did not see her again until June, 1880. The bleeding had

rather increased in quantity, and I was then first informed that it occurred at the menstrual periods; at such times the patient often, but not always, suffered from severe headaches, and if the bleeding from the ear occurred during such headaches, it would relieve the head. The patient had formerly at such periods had nose-bleed, but this had ceased entirely since the ear-trouble began. The hemorrhage was quite profuse, sufficient at a time to cover a handkerchief, and might occur several times during one menstruation. There were no symptoms in the ear—neither pain, noises, throbbing, nor deafness, and examination showed nothing abnormal except that, at the seat of the former slight prominence, there was now a distinct sebaceous tumor, as large as a bean, upon the lower edge of the meatus, which the patient said had been increasing in size for some months. The skin over this was extremely thin and adherent to the tumor, and its surface was dotted with minute red spots, the seat of the last hemorrhage a few days before.

The appearances of the skin over the tumor, and the assertions of both the patient and her mother, convinced me that this was the source of the hemorrhage, and, as the tumor was increasing in size, I advised its removal. This was done by elliptical incisions embracing the base, and then dissecting out the whole mass. The contents of the cyst was sebaceous secretion, and the growth was nourished by a single artery of large size, considering the size of the tumor, which entered at its base. Five months afterward there had never been any return of the hemorrhage from either ear or nose, and the headaches at the menstrual period were about the same as ever—certainly no worse.

In one other case, seen several years ago, I met with the same phenomenon in a lady about thirty years of age. In this case, however, the drum-membrane had been largely destroyed by previous disease, and the tympanic mucous membrane was directly exposed. Occasionally, but not always, during menstruation there was a hemorrhage from this exposed membrane of considerable amount, but of short duration. Unfortunately, I am unable to find the notes of the case, and cannot state whether, as in the first case, there was any marked tendency to congestion of the head at such periods.

HERPES ZOSTER.

An old man, aged seventy-five years, appeared at my clinic at the City Hospital, complaining of severe pain about the ear. He had always been well, and there had never been any disease of the ears. A few days before, without known cause, he began to suffer from severe pain, which started at about the middle of the right sterno-mastoid muscle and shot up through the ear to the vertex of the skull; it was so severe as to deprive him of sleep, but was unaccompanied by any other symptoms. Examination showed the ear perfectly normal in appearance and function. The skin at the seat of pain was natural, but there was a slight tenderness over the whole affected region. He was ordered morphia in one-eighth grain doses till the pain was relieved; the affected region was covered with cotton batting, and he was told that he might continue the application of goose-oil, which he had begun to use without advice.

Two days after he reported that four doses of the morphine (one-half a grain) were required the first night to allay the pain, which did not return till the following night, when two doses then gave equal relief. Nothing could be discovered at this visit. In two days he again returned and reported himself entirely free from pain, so that he had slept well the previous night without any morphine. I now found for the first time two circular patches, each about the size of half a dollar, composed of small vesicles, upon the right side of the head, well up toward the vertex. The previous slight tenderness of the skin had now disappeared. The patient was under observation for ten days longer; there was no further return of pain, no new eruption over the seats of previous pain, and the two patches of vesicles gradually dried up, so that when the patient was last seen they were scarcely distinguishable.

Mary McL., aged twenty-two years, single, was brought to the City Hospital on December 19, 1880, with flooding and a retained and adherent placenta following an abortion, probably at about the fifth month, on the previous night. She was under the care of Dr. C. E. Stedman, through whose kindness I saw the case. On December 21st there was a well marked and characteristic

eruption of measles, then very prevalent throughout the city. On December 24th, during the night, she complained of "burning pains" through the right side of the head and ear, which she described as very severe, and the next morning there was an eruption of vesicles over nearly the whole posterior surface of the auricle, with what she described as a "smarting pain" strictly localized at the seat of eruption.

The next day the pain was much less, and the vesicles were increasing in size. December 27th, the next day, the vesicles were becoming pustular. December 28th the eruption was distinctly pustular and becoming confluent, the pain was gone entirely. December 29th the pustules had dried up to crusts, and there was no pain. January 3d the patient was discharged well.

The measles ran a regular course wholly independent of the zoster. At no time, either from the measles or the zoster, was there any affection of the deeper parts of the ear or of the functions of that organ.

CYSTIC TUMOR OF MEATUS.

In December last I was consulted by Mrs. C., aged eighty-two years. For the last two years there had been a slowly increasing deafness; for the last two months this had become much worse, but was somewhat variable. Examination showed that the hearing was much worse on the right side than on the left, and that the right meatus was closed by impacted cerumen. After thorough removal of the cerumen, the hearing of the right ear became equally good with that of the left. The interesting point in the case, however, was the existence of a large cystic tumor on the lower walls of the meatus, reaching from near the external orifice almost to the membrana tympani, and occupying fully two-thirds of the calibre of the passage. It was soft, distinctly fluctuating, and superficial, being covered merely with a thin and adherent skin. There was no history of any previous inflammation or pain. The presence of the tumor had evidently favored the retention of the cerumen, which, by closing the passage, very much increased a preceding tympanic deafness.

On account of the age of the patient, and from the fact that the tumor produced no inconvenience, I did not advise any interference. It is the first tumor of the kind I have ever seen in this situation.

THE CURE OF OTORRHŒAS IN PHTHISICAL PATIENTS.

In common with all authors who have written upon the subject, I had regarded a muco-purulent discharge from the tympanum with a large perforation of the drum-membrane, when associated with well-marked and advanced phthisis, as beyond the reach of medical art, on account of the chronic tendency to secretion which then exists in the mucous membrane, and the slight reparative powers in the tissues. In the course of a twelve years' connection with a large general hospital where I have had constant opportunities of studying all varieties of diseases of the ear associated with general diseases, I had come to regard nothing as so absolutely hopeless as chronic uncomplicated otorrhœa in a phthisical subject. I had seen serous inflammation of the tympanum undergo absorption and resolution while the patient was in the last stages of Bright's disease, with general œdema. I had seen purulent tympanic inflammation, both acute and chronic, heal perfectly under the same general conditions, but when associated with phthisis had failed so often in arresting the discharge that I regarded it as an impossibility. In two quite recent cases, however, the results were so unexpected and so good that the cases are worthy of record.

The first case was that of a man aged about fifty years, who was in the City Hospital with empyema of the chest, associated with tubercles of the lungs. A permanent opening had been made in the chest, with relief to the suffering, but there were all the physical signs of advancing tuberculosis of the lungs. While in this condition, and slowly failing day by day in strength, a discharge, without preceding pain, began from the left ear, for which I was asked to see him. Examination showed a muco-purulent tympanic inflammation, with perforation of the drum-membrane; the inflammation was not of the intense character usually seen in acute

cases, but the membrana tympani was slightly œdematous, grayish in color, and showing here and there lines of injected capillary vessels; the tympanic mucous membrane was pale, not perceptibly swollen, but with injected capillaries. The drum-membrane slowly melted away till about two-thirds of it were lost, and the same destructive process then followed in the mucous membrane of the tympanum, till finally the whole inner wall over the promontory was divested of its membrane, and the bone left exposed and roughened, as could be both seen and felt very distinctly. The discharge then gradually diminished in quantity, and healing went on regularly till the promontory was covered with a thin and delicate mucous membrane, the discharge ceased entirely, and there were some attempts at closure of the large perforation, when the patient was removed from the hospital by friends. The treatment of the ear was by syringing, and the use of astringent solutions of sulphate of zinc. The general condition of the patient was about as bad as it could be, and he failed steadily so long as he remained in the hospital. The gradual melting away of the tissues in the ear was such as I had seen in similar cases; but when the bone was finally exposed, I supposed the result would be an extensive caries of the petrous bone. I satisfied myself and demonstrated to others the reparation which had taken place in the tympanum, and after the healing occurred in the mucous membrane the patient was under observation for several weeks, during which the tympanum was entirely free from discharge.

The second case was that of a gentleman aged about forty years, with advanced phthisis. With slight pain and fulness for two or three days, a discharge began in the left ear, and when I saw him there was a minute perforation of the membrana tympani in its anterior segment; the membrane was free from all congestion and swelling, the discharge was entirely from within the tympanum, muco-purulent, and at first very slight in quantity. The slight pains which existed at first disappeared, the discharge increased in quantity, and in the course of some three weeks the whole drum-membrane had melted away without my being able to appreciate any preceding inflammatory changes in it. All I could say was that, from visit to visit the perforation was larger and larger, till

the whole membrane had disappeared. The discharge then gradually ceased; the tympanic mucous membrane, which had been slightly congested and swollen, slowly assumed its normal, delicate structure and light color, and became perfectly dry. The hearing, for both the watch and voice, had meanwhile been lost entirely, as I assumed from changes in the labyrinth, and there was no gain in the hearing as the inflammation subsided. There never was any return of discharge after it had once ceased, and during the rest of the patient's life, about six months, the ear remained dry, but *totally* deaf. The treatment used in this case was, covering the parts with pulverized boracic acid, and closing the meatus with carbolized cotton.

Both of the cases are interesting examples of the destruction which sometimes occurs in wasting diseases, but are reported here on account of the permanent results obtained in the otorrhœa notwithstanding the very unfavorable condition of the patients.

DISTRESSING NOISE IN THE EAR, PROBABLY DUE TO SPASMODIC ACTION OF THE TENSOR PALATI.

By CHARLES A. TODD, M.D.,

ST. LOUIS, MO.

May 8, 1880, Mr. H., of Chillicothe, Missouri, aged twenty-eight, unmarried, came under my charge on account of a very distressing condition of the right ear.

During the year 1876 he had been much exposed to the weather in the course of business, travelling on horseback through the country. The following winter he experienced a feeling of pressure and heaviness in the right side of the head, which he attributed to a severe cold contracted during the previous spring; this sensation he referred to the region of a depression which existed at the site of the squamo-parietal suture, a little above the level of the external auditory meatus (in his second year the suture was probably open at that spot, as his parents were careful to protect it from any pressure). The following autumn he heard "in the same region a peculiar clicking, creaking, or rustling sound" upon moving the head from side to side. This movement he found to relieve temporarily the sensation of pressure, which had become distressing. The pressure and noise was worse in chilly weather. "His hearing was not affected." The noise sometimes could be heard twenty feet off.

These phenomena at last gave rise to such anxiety and depression that he consulted physicians, but without obtaining relief. Latterly he entertained the notion that there was some disturbance of the circulation in the head which gave rise to his suffering—possibly an aneurism; the above-mentioned cranial depression helped to create the notion and to fix the locality. Indeed, such was his condition of mind over it that he rather snatched at the idea of

trephining (suggested by me in jest), and apparently would have willingly submitted to the operation in the face of all risks.

Examination: Patient of a highly nervous temperament, intelligent; size of cranium above the average. Habits strictly temperate; had given up the use of tea and coffee for two years, does not use tobacco. Has always suffered from incontinence of urine—less so latterly. Several years ago was treated for obstruction of the colon; still has a feeling of weakness in left inguinal region, which compels him to walk with a cane. There is a small, but distinct depression of the skull at the region already described, in the neighborhood of the right ear. The noise (much like a subcrepitant râle) I can hear half a foot off; patient states that to-day it is less distinct. It is produced upon a movement of the head, effected by a strained action of the sterno-cleido-mastoid muscle in a lateral direction and from below on the right side upward. It is heard more distinctly through a stethoscope applied to the mastoid process, and also at the nostrils and open mouth. Upon close examination, the soft palate (which is markedly relaxed, but not œdematous nor thickened) is seen to move as if in response to contraction of the tensor palati, at the time the sound is observed. Closely questioning the patient, he thinks that he can produce the same sound without moving the head or contracting the muscles of the neck, and that the frequent production of the sound tends to aggravate the sense of pressure, and tries to avoid making it.

The right membrana tympani is a little congested, the malleus is fixed, and only the anterior superior quarter is seen to move under Siegle's pneumatic speculum. The left membrana tympani is somewhat opaque and sunken, but it is movable. Eustachian tubes free. Hearing distance for both ears three feet, for a watch heard normally five feet. Inflation of the middle ear does not alter the hearing distance. Diapason heard a little better in left ear. Thinks the noise is making its appearance in the left ear. Has a chronic "dry" nasal catarrh; takes cold easily.

As a rule, sleeps well, but is sometimes wakeful and nervous. Notices the pressure in the ear upon waking; it becomes worse, if at all, toward evening or after fatigue.

The patient's history and the results of the examination point

conclusively to the middle ear as the seat of the whole trouble—the local catarrh, reacting upon a highly nervous temperament, giving rise to the whole train of symptoms. I felt obliged, however, to yield to the wishes of the patient and consult with a surgeon in respect to the supposed "aneurism." Prof. John T. Hodgen, M.D., made an examination of this interesting case, confirming my opinion as to the exact location of the sensation of pressure. Fearing that there might be some actual brain-lesion complicating the symptoms, I obtained the opinion of Prof. J. K. Bauduy, of the Missouri Medical College, to the effect that the intensity of the patient's anxiety, and his constant dwelling upon the aural discomfort, might end in a mental state approaching insanity, if indeed there was not already some mental aberration; he was inclined to the belief that the condition would end unfavorably.

As a first step in local treatment following the indications—congestion and immobility—I incised the right membrane, blood appearing at once, but no other liquid. The paracentesis was performed in the inferior posterior quarter. The wound promptly healed, there was no material improvement upon the usual manipulations, and further direct treatment of the tympanum was omitted. There did not appear any good reason for washing out the tympanic cavity, and, as already stated, the Eustachian tube was open. I now concluded that there was a congested state of the tympanum without collection of secretion, which gave rise to a sensation of fulness or pressure. This sensation the patient instinctively tried to relieve by the forcible opening of the Eustachian tube by muscular action alone, the separation of the tubal walls giving rise to the crackling sound. To effect this opening of the Eustachian tube a number of muscles were called into action, most palpably the sterno-cleido-mastoideus and probably the internal pterygoid, as the jaw was rigidly held at the time and some fibres of this muscle take origin upon the fascia of the external tubal wall. Of course the muscular action outside the tubal region was superfluous, and due to the patient's ignorance of the proper method of inflating the ear.

Besides the general tonic treatment and strict hygienic regimen which had been prescribed at the outset (Prof. Bauduy also having

applied the actual cautery to the nape, with the happiest results upon the mental condition), I now made use of the faradic current, passing it through the Eustachian tube—one pole being introduced into the pharyngeal mouth, the other stroked about the external meatus; the current used was the weakest that could be felt. I confess this latter was more of the nature of a placebo; it was applied daily, to the patient's great satisfaction, while the physician watched the effect of the phosphates, malt liquors, open air exercise, and general moral encouragement. The congestion of the membrana tympani had meanwhile disappeared.

Improvement quickly became noticeable, the patient declared that the sense of pressure had lessened, and with it the need of making the distressing rattle. In the course of a month his relief was such that he decided to return home. A letter from him, dated August 25th, stated that the trouble had returned and was about as bad as ever, since which time I have not heard from him.

TWO DIFFICULT CASES OF FOREIGN BODIES IN THE EAR.

By H. D. JOY, M.D.,

NEW YORK.

I have always considered the use of instruments in the removal of foreign bodies (such as beads, beans, shells, etc.) from the auditory canal unjustifiable, unless they have been pushed deep into the ear and impacted. Syringing very frequently will accomplish the removal, provided the case has been seen soon after the accident, and before attempts have been made by persons who do not understand the proper treatment of the ear. Even in the hands of the experienced surgeon, however, there is danger of the water driving the foreign body farther into the canal; or, in the force required to expel it from the ear, there is a risk of injuring the membrane.

Very few authorities advocate the use of instruments—from the fact, no doubt, of their awkwardness and inefficiency. We have several styles of ear-forceps and curettes that are small enough to pass through the speculum and probably grasp the foreign body, but until lately I have not seen one of sufficient power for firmly grasping, and retaining its grasp, upon certain objects.

Two cases have come under my observation at the New York Eye and Ear Infirmary, where treatment was of no avail without an anæsthetic, and which illustrated the bad effect of exploring the ear without a knowledge of its anatomy and without the use of proper appliances. The experience derived from these two cases has led me decidedly to favor the use of properly constructed forceps for the removal of foreign bodies.

Case I.—A boy, seven years of age, while playing with some locust-beans, pushed one into his right ear.

He was taken to a physician in the neighborhood, who attempted to remove

it, but who only succeeded in forcing it farther into the canal, lacerating the surrounding tissues by the operation.

Four days after he was brought to the infirmary, where examination by reflected light, through the speculum, showed the bean to be embedded in the canal close to the membrana tympani, which was perforated. The surrounding parts were so much swollen that syringing was of no avail. He was sent home with the understanding that he should return the next day. He did not appear again for one week, during which time he had suffered no pain; the appearance of the canal and the location of the bean remaining the same. The mother brought a locust-bean of the same size as the one embedded in the boy's ear, which Dr. Samuel Sexton, who has kindly aided me in operating on this case, took to experiment with. The patient was etherized, and an attempt again made to remove the seed. It was unsuccessful, the forceps and curette used being too weak to retain a hold upon the hard, polished surface of the bean.

He was not seen again for two months. During this interval of time Dr. Sexton placed a specimen of the bean in a small vial of water to macerate, the temperature being kept at about 65° Fahrenheit. The mouth of the vial was in diameter one-fourth of an inch larger than the largest diameter of the bean. In thirty-six hours it had swollen too much to pass through the mouth of the vial without being forced through by the aid of forceps. On the third day the water in the vial was cloudy, and seemed mucilaginous in character; on the fifth day the forceps easily broke through the shell at the smaller end, and the contents were softened, but too tough to be broken down with the forceps. Six days later the seed was a little larger, and the broken end being attacked, the contents of the tough and still intact shell were easily picked out.

The fruitless attempts to remove the foreign body a month previous suggested to Dr. Sexton the construction of the aural foreign-body forceps, described in the American Journal of Otology, Vol. II., No. IV. During these two months the patient had suffered no pain, but there was a free discharge of pus, and a small polypus was discernible, by reflected light through the speculum. This was removed, and the patient etherized, and several small pieces of the shell and the fruit removed with Dr. Sexton's new forceps. I am positive that if we could have used these forceps in the first operation, the bean would have been removed in its entirety. The child disappeared from observation for five months, when he was again brought by his mother. There was a free discharge of pus, and several polypoid growths obstructed the canal. These were removed by means of the snare, and all but a small portion of the bean was removed by the forceps, the fragments coming away piecemeal, in thin, rather tough sections, the breaking-down having taken place in the same manner as in the specimen macerated. The case is still under observation, and

the remaining portion will probably soon pass out of the canal without surgical interference.

Case II.—A child, two years of age, had forced a glass stud, with brass setting, into the right ear. A physician, with a druggist's assistance, succeeded in pushing the article close down to the membrana tympani. On examination by speculum, the stud—a round one—was distinctly visible. It almost filled the canal, and was firmly impacted. The child was etherized, and two ordinary styles of forceps were used, which grasped the stud, but slipped off as soon as the slightest traction was made. Dr. Sexton's forceps were then applied, and the stud was at once seized and easily removed without any undue force, and without the instrument losing its hold.

BOOK NOTICES.

On Deafness, Giddiness, and Noises in the Head. By Edward Woakes, M.D., Lond. Pp. 224. Second edition, enlarged and revised, with illustrations. Reprint. Philadelphia: Presley Blakiston, 1880.

The first edition of Dr. Woakes' book was reviewed in this journal (Vol. I., p. 219), since which time a second edition has been found necessary. In the preface to the second edition the author states that, by the addition of new matter, he has carried on the natural history of deafness from a causative point of view. Two new chapters have been added, with the purpose of continuing the etiology of deafness beyond the periods of infancy and childhood, to which, in the first edition, his remarks were limited, and extending it through the ages of adolescence and adult life. The author does not lay out for himself the task of an exhaustive *résumé* of all the causes that are concerned in deteriorating the hearing-power, but he has given the greater amount of attention to tracing to their source in the vaso-motor system the trophic tissue-changes that are believed to be so frequently the cause of disease of the middle ear.

Inasmuch as those who are especially interested in this question of the sympathetic relationship of distant organs with the ear will wish to peruse the work of Dr. Woakes in order to obtain his views on the subject, we shall make no attempt to consider them here. The question of treatment as based upon Dr. Woakes' etiology and pathology, however, is one of interest to all, inasmuch as a new departure in treatment would seem to be indicated should the theories that he has so well formulated be accepted.

As regards the treatment, then, of infantile otitis, the reviewer would at the start take issue with the author in both his pathology and his treatment. On pp. 1 and 2 the author says: "Now, the point which I wish to emphasize is this: the pain thus experienced is not what we vaguely call neuralgia; it is a definite trophic change, an inflammation taking place in the deeper-seated tissues of the ear, beginning with congestion and stretching of an acutely sensitive region, passing on to exudation and suppuration, and capable of being recognized if the proper means are used for doing this. If the case be seen early, all these symptoms are at once removed by a free incision of the swollen gums."

We have long observed with much interest the progress of these infantile cases, and in our experience it has been found that only in exceptional

cases has the attack been of sudden occurrence; that in the greater number of instances aural congestion has for some time existed to a greater or less degree, and that usually, in addition to the irritation of dentition, there has been naso-pharyngeal catarrh—probably antedating the cutting of the teeth. Slight trophic changes are, at this age, apparently sufficient to cause great deafness from their effects upon the conductive mechanism; but, owing to the want of any adequate test for determining the hearing-power in the infant, we can only approximately determine the degree of injury in any given case. Given a certain degree of oro-pharyngo-nasal irritation, the sudden invasion of a cold in the head will be likely to be followed by an attack of otitis media catarrhalis, either simple or purulent. The symptom of earache may or may not be a symptom in either event, or the non-suppurative attack may be characterized by severe pains, which will subside when suppuration takes place.

Authorities are divided upon the question of lancing the gums in these cases; our experience so far leads us to place less reliance upon this measure than do most practitioners. Earache frequently occurs during dentition, when swelling of the gums is not so likely to be a cause of reflex irritation as the naso-pharyngeal catarrh which, in these cases, so frequently coexists.

The general practitioner is usually called upon in these cases, and should a discharge become established and his attention be called to it, "he is careful," says the author, "to inform the friends of the danger attendant upon checking such a useful derivative!" In considering the motive that has induced the general practitioner to adopt the "let alone" treatment, we are inclined to believe that it was the wiser course, for it is certainly much better for the patient to be "let alone" than to be experimented upon; many children have thus been spared the torture of meddlesome practice. Our present experience leads us to hope that the methods of treatment now in vogue may soon give way to the old-fashioned plan, for the general practitioner WILL treat these cases, and, inasmuch as it has of late been taught that prompt treatment is required (by the expert), he himself goes on with syringing and leeching, attempting to lance the drum-head, instilling astringent and irritating solutions into the ear, incising and blistering the mastoid, until a simple case soon becomes one of serious import. These heroic methods are like a sharp-edged weapon, which is capable of cutting both ways, and they should be employed by those only who are skilled in their use. The results of this treatment that frequently come to the expert illustrate the saying that "a little learning is a dangerous thing."

The author (p. 17) assumes that an examination of the drum-head of the patient will have been made in these cases before the line of treatment has been decided upon, and that such an inspection is easy of accomplishment. We believe that at the period when most of the cases are presented for treatment such a course is impracticable, and, in fact, often impossible. The drum-head of an infant in health is not by any means easily seen; but when the patient is suffering from inflammation of the parts, when the external auditory meatus

is narrowed and contains secretions or exudative matter not easily removed without giving pain or injury, the procedure is yet more difficult of accomplishment.

The author recommends as the next measure, if the ear be found in an inflamed condition, the abstraction of blood from the ear by means of two leeches to be applied within the concha; or, if circumstances prevent this spot being selected, they may be placed in front of the tragus or behind the ear instead. Our own experience in the use of leeches does not give us the confidence in their employment that is possessed by many, and we therefore resort to their use exceptionally; indeed, in many cases the savage bite of the leech causes an increase of existing irritation, thus doing decided harm. At the same time that the leeches are applied the author recommends the administration of drop doses of Tr. aconite, B. P., "because it diminishes the heart's action and lessens the sensitiveness of the peripheral nerves." Those who administer aconite in these cases should remember that the tincture of the British Pharmacopœia is only one-third the strength of that of the U. S. P. We are of the opinion that the dose laid down by Dr. Woakes, although only one-third of a drop of the drug, is greatly in excess of what is required to lessen the pains of the disease under consideration.

Should the case go on after the methods of treatment just mentioned have been tried, the author then considers the necessity of puncturing the drumhead. The operation is described as not difficult, and the operator is advised to use a bivalve speculum for admitting the light to the membrane. The knife used by the author in making the incision is one that is projected from a sheath by a spring at the moment the operator is ready. "The after-treatment consists in very gently syringing the ear with a solution of bicarbonate of soda in warm water, to remove the fluid in the tympanic cavity." In older subjects the syringing is not only to include washing out the tympanic cavity, but the force used is to be sufficient to also wash out the mastoid cells and to drive the fluid through the Eustachian tube to the mouth. "The syringing must be repeated several times daily, to prevent the establishment of an otorrhœa, and for this purpose a few drops of carbolic acid may be added to the alkaline fluid."

Measures like these are no longer employed to the same extent as formerly; some of them may be said to have fallen into almost entire disuse. The operation of myringotomy in infants has not been found to be devoid of difficulties, and the reviewer believes that when undertaken the patient should be put under the influence of an anæsthetic, a practice not mentioned by the author. Otherwise the operation is a cruel one, and in the end amounts to but little more than an uncertain stabbing of a most sensitive region in the dark. To attempt to wash out the cavity of the tympanum after one of these stabs is often impracticable, and, could it be readily accomplished, we should fear that the result would be the establishment of an otorrhœa rather than its prevention.

The influences of post-nasal growths is discussed in the third chapter of the book, and we can but commend its perusal to all who have an interest in the subject. Dr. Woakes presented the subject in a strong light, and we have no doubts as to the important influence such affections have upon aural diseases. The work done by the author in this field has been of a decidedly clear and original style, as the readers of the AMERICAN JOURNAL OF OTOLOGY can attest from his contributions to our columns. To post-nasal growths and paretic deafness the author devotes some forty pages of the book. Lack of space will not permit us to enter into an analytical review, did we feel competent at this stage of the investigation of these subjects, to do so. The author's researches have taken him away from the stereotyped notion of an inflammatory process being the invariable concomitant of so-called *throat-deafness*, while the neuroses of the palato-tubal muscles have assumed more important proportions in relation to aural defects; thus, he finds that deafness is not unfrequently met with where the ear itself, so far as our visual examination goes, presents very slight changes in its appearance.

In the light of the etiological factors which the author has brought into prominence in connection with certain cases, we are no longer warranted in referring all obscure cases to the domain of chronic inflammation of the middle ear.

Dr. Woakes very justly dwells upon the danger to life that follows the neglect of aural complications in the exanthemata, typhoid fever, etc. He draws attention to the symptoms in the progress of these diseases, that, if correctly interpreted, would account in many instances for the grave cerebral symptoms which are attributed to "blood-poisoning." Thus, it happens that during the usual progress of the illness the patient becomes restless, he experiences pains that give rise to restless movements and impatient exclamations, and withal there is an indisposition to converse; these are symptoms, he believes, that depend upon deafness and inflammation in the ears.

The chapters that treat of ear-cough, ear-sneezing, giddiness, and noises in the head, have been somewhat revised in the second edition before us. They should be carefully studied by every otologist who wishes to increase his knowledge of the etiology of aural diseases. The phenomena of tinnitus aurium are not, we believe, best studied from a strictly physiological standpoint, but the ground that yet needs clearing up must be viewed by the light of acoustics, so to speak. The conduct of sound, when modified by the various pathological conditions of the auditory apparatus, should be studied as well as the sympathetic influences that induce these changes.

We have read the second edition of Dr. Woakes' book with the same interest and pleasure as we have the first edition, and in writing this incomplete review have been inspired by no unfriendly spirit; on the contrary, we feel much indebted to him for the valuable work he has done in unravelling the subject of the nervous relationship that exists between the ears and other organs, and for his contributions to the subject of post-nasal growths.

That our treatment of aural diseases should be improved with our increasing knowledge of aural pathology is naturally to be expected, and we are, therefore, disappointed to observe that the therapeutics and surgery of our contemporaries on the other side of the water have not greatly changed in the past decade.

The author's style is concise and lucid, and his English is unexceptionable.

Hygiene and Treatment of Catarrh. Part I. By Thomas F. Rumbold, M.D. St. Louis: George F. Rumbold & Co. 1881.

Dr. Rumbold has undoubtedly chosen a wide and most attractive subject for his book, in the hygienic treatment of nasal catarrh, and one which has not received the attention that it deserves at the hands of writers on this disease; but, unfortunately, we fail to discover any marked evidences in the paper of his fitness to treat of the matter he has undertaken.

He divides his subject into two heads, hygienic and sanative measure. Under the former he discusses in several rather fragmentary chapters the question of clothing, colds, atmospheric influences, diet, exercise, and disposition of the mind. Under the latter head he discusses cleansing of the nasal passages, and ears, the teeth, bathing, inunctions, and the use of tobacco. He closes with the title-page of Part II., which is to treat of Therapeutic and Operative Measures.

We find the book replete with careless statements, often ungrammatically expressed; directions, which, if not mischievous, are certainly injudicious; and references to pathology which are, to say the least, surprising.

There seems to exist an impression on the part of some of our Western friends, which finds occasional utterance in their journals, that a book by a Western writer meets with but scant favor at the hands of the Eastern profession. That this accusation is an unjust one is evidenced by the very favorable reception which has been accorded a number of thoroughly good books, for which we are indebted to the profession in the West. The opinion which must needs be recorded of the work under consideration is both an evidence and an explanation of the feeling of Western reviewers.

Diseases of the Throat and Nose. By Morell Mackenzie. Vol. I.—Pharynx, Larynx, and Trachea.

It is always unsatisfactory to review an incomplete work, for the reason that omissions noticed in the first volume may be made good in the second. This is very likely to be the case in the instance of the book whose title is quoted above, when we recall the relation that the ear bears to both the pharynx and the nose. The pharynx is treated of in the first volume, while the nose is reserved for the second. It is manifestly unfair to judge of the author, in matters in which aural surgery is related to laryngeal and nasal surgery, until his case can be rested, with all the evidence in.

Taking the first volume as it stands, we confess to acknowledge great disappointment that the ear has not received more attention in its connection with the symptomatology of affections of the pharynx. Mr. Mackenzie may be said to snub the entire subject. It is true that here and there brief allusions are made to it; but, oftener than not, in a general and sometimes even in an inaccurate way. A few quotations will serve in illustration of this. Under the head of Granular Pharyngitis it is stated: "As a consequence (of the extension of the disease to the naso-pharynx), the malady is sometimes accompanied by impairment of hearing in proportion as the orifice of the Eustachian tube participates in the morbid process." The participation of the parts in question in direct involvement of the tubal orifice is an exceedingly rare event, while the impairment of hearing is common. The general statement of the tendency toward involvement is correct, but the etiology is erroneous.

In like manner Mr. Mackenzie states, under the head of Symptoms of Quinsy, that the hearing is almost always affected. Some accredited writers deny this. Surely the entire case should have been stated in a matter where authorities can be so readily consulted. The same statement is made (p. 77) with respect to hypertrophy of the tonsil, but with more reasonable methed, inasmuch as the manner of inducing the deafness is elucidated. In his chapter on the angina of scarlet fever not a word is said respecting its connection with the middle ear—surely, a remarkable omission. With reference to pain in the ear as a symptom of pharyngeal and laryngeal disease, our author is generally silent; and when he makes a statement it is of a vague character, as when he says, under the head of Cancer of the Pharynx, "that the pain becomes greater when ulceration commences, and often darts into the ear."

These remarks are made in no carping spirit, but merely to state, so long as the volume has been sent to us to review, that, so far as otology is concerned, Mr. Mackenzie's work interprets nothing that has been obscure before his volume appeared.

REVIEWS.

THE PHOTOPHONE. By LORD RAYLEIGH: *Nature*, January 20, 1881.—In this article the author shows that, with sunlight, a plate of iron subjected to about two hundred and fifty intermittences per second will, under the influence of unequal heating of the opposite surface, be bent so that its centre is displaced by five one-millionths of a centimetre. This would probably produce an audible sound, so that there is no reason for discarding this most obvious explanation of the action of radiant energy discovered by Professor Bell.

C. R. CROSS.

ACTION OF AN INTERMITTENT BEAM OF HEAT UPON GASEOUS MATTER. By PROF. JOHN TYNDALL: Paper read at the Royal Society, January 13, 1881. *Nature*, February 18, 1881.—The photophone of Mr. Bell has recently been applied by Professor Tyndall to the investigation of the absorption of radiant heat by gases and vapors. An electric light was used as a source of energy.

Sulphuric ether, formic ether, and acetic ether, in a vaporous condition, when subjected to the action of the intermittent beam, gave a clear musical sound. These were, according to Professor Tyndall's earlier researches, highly absorbent substances. On the other hand, diathermanous vapors, as chloroform and bisulphide of carbon, gave very feeble sounds, the bisulphide giving the feeblest note. Vapors of amylene, iodide of ethyl, iodide of methyl and benzol, gave sounds louder in proportion to their absorptive power for radiant heat. This effect was clearly proved to be caused by absorption by the vapor, and not by its liquid, by various experiments. A rock-salt cell entirely filled with a volatile liquid gave no sound, but if a bubble of vapor was present a sound was heard.

Gases were also experimented upon. A flask filled with carefully dried air gave a feeble note, as did also dry oxygen and hydrogen. Carbolic acid gave a louder sound, and nitrous oxide one still louder. With olefiant gas the sound seemed as loud as with an ordinary organ-pipe. The amount of absorption and the intensity of the sound go hand in hand. Ammonia and water-vapor gave loud notes. In fact, the method was found a very delicate one for testing the absorptive power of gases and vapors. A layer of absorptive liquid, as water, formic ether, or sulphuric ether, placed in the path of the rays rendered the transmitted beam powerless to produce sound, showing that it is the obscure heat-rays that are chiefly active. A solution of iodine in

bisulphide of carbon, on the other hand, produced scarcely any diminution of the sound.

Similar results were afterward obtained with the lime-light, a candle, a red hot coal, and a red-hot poker. The heated poker being allowed to cool, continued to produce a sound until it had reached the temperature of boiling water. It was also found, in later experiments, that the faint sounds at first obtained with dry air were due to the presence of a slight quantity of water-vapor.

Professor Tyndall also succeeded in obtaining sounds from patchouli and cassia, and other substances which his previous researches had shown to be good absorbers of radiant heat.

Some anomalies were noticed with vapor of bromine, which were shown to result from the high intensity of the source of heat used—the lime-light.

Sounds were produced even when the beam was concentrated by a lens of ice. Some of the more active vapors produced sounds when at a distance of one hundred feet from the source of rays. C. R. C.

Report of Gruber's Clinic in the General Hospital, Vienna, for 1879.—From extracts of the report in the *Monatsschrift für Ohrenheilkunde*, October, 1880, we take the following:

		Males.	Females.
Whole number of patients in 1878	1,814	1,093	721
Indoor patients	138	82	56
Cured	982	623	359
Improved	490	280	210
Unrelieved	64	36	28
Not treated	125	67	58
Died	1	1	—
Remaining under treatment	152	86	66

The ages of patients were:

½— 5 years	124	70	54
5—15 "	292	160	132
15—30 "	563	331	232
30—50 "	470	294	176
50—60 "	147	101	47
60—80 "	71	49	22
over 80 "	2	—	2

Among the interesting cases seen were two of herpes auriculæ in young persons, thirteen and nineteen years old, which showed fine vesicles arranged in groups around the entrance of the meatus and over the concha, and which were preceded by itching and burning pain.

Foreign bodies exhibited the old story, in a few instances, of previous in

judicious attempts at removal, one of which had driven a carob-bean through the membrana tympani into the tympanum, where it wás impacted. After two months' treatment to allay the resulting inflammation the foreign body was removed by syringing. Most of the other foreign bodies were readily removed by the syringe alone.

Circumscribed inflammation of the meatus was treated successfully by gelatine bougies of morphium acet. and opium ; diffuse inflammation, by spiritus vini rectificatissimus.

Collapse of the meatus was seen once in a man aged seventy-nine ; the anterior and posterior walls of the meatus lay in close contact from simple relaxation. Relief was afforded by wearing funnel-shaped tubes of hard rubber.

Under perforation of the drum-membrane, one case is narrated of great benefit obtained from the use of an artificial membrane of linen, as already recommended by Gruber; it could be worn from two to three months without being changed.

In relaxation of the drum-membrane, multiple perforation was used, but not always with satisfactory results; but excision of a portion of the relaxed membrane by means of the galvano-caustic, which was used in five cases, was attended by brilliant results. The reaction was slight and the membranes all healed within three weeks.

In the treatment of chronic catarrh of the tympanum, great stress is laid upon the therapeutics of the naso-pharynx. For catarrh of that cavity, painting with nitrate of silver, 10 per cent., syringing the nose with a solution of borax and the use of nasal bougies of sulphate of zinc, tannin, and sulphate of copper are recommended.

For chronic purulent inflammation of the tympanum, gelatine bougies of sulphate of zinc, nitrate of silver, and carbolic acid were used, being applied to the carefully cleansed ear. Where the perforation was large, linen membranes, covered with oxide of zinc or nitrate of silver ointment, were applied.

RADIOPHONY (Sur la radiophonie). By M. E. MERCADIER: *Journal de physique*, Feb., 1881 ; Abstract in *Nature*, Feb. 17, 1881.—The author prefers the title *radiophony* to that of "photophony," since he shows that light-rays, so called, are not the only ones capable of producing the photophonic effect discovered by Professor Bell.

The general law as laid down by the discoverer may be stated as follows: "Whenever a solar ray is rendered intermittent, as, for example, by its passage through openings in the border of a rapidly turning metallic disk; if it is caused to fall upon a thin plate of any body whatever, this plate, placed against the ear either directly or by the intervention of a tube of caoutchouc and a hearing-trumpet, gives forth a sound whose number of vibrations is equal to that of the intermittences of the luminous ray in a second."

M. Mercadier avoids the heaviness of Mr. Bell's brass wheel, and also the

sound made by the openings in the wheel against the air, by substituting a glass wheel, covered with paper, out of which the holes were cut. Several series were used, as in a polyphone siren, so that different notes could be either successively or simultaneously produced. The mechanical devices by which this is accomplished, and the form of the receiver, are fully described.

The only bodies experimented upon were solids. The following are the chief results:

"A. Radiophony does not appear to be an effect produced by the transverse vibration of the receiving-plate, as in the ordinary transverse vibration of a plate."

This follows from the facts that it (1) produces equally well, and without any break of continuity, all successive sounds from the gravest to the most acute; (2) that in the same way it produces in a continuous manner various accords on changing the speed; and (3) variations in the thickness or breadth, with the same speed, do not alter either the pitch or the quality of the resulting sound.

In the case of opaque plates in the receiver, the intensity of the sound produced decreases rapidly with the thickness, while with transparent plates the intensity does not change. (4) A cracked or broken plate gives equally good results as if whole. These facts show that the plate cannot vibrate transversely by its elasticity.

"B. The nature of the molecules of the receiver and their mode of aggregation does not appear to play a prominent part in the production of the sounds." The nature of the substance does not seem to affect in any way the quality of the sound produced. Ordinary and polarized light produce the same effect.

"C. Radiophonic action seems to be the result of an action taking place at the surface of the receiving-plate." The intensity of the sounds produced depends on the nature of the surface. Any change in this affects the intensity of the sound. Thus, substances which, like white-lead, zinc-white, chrome-yellow, etc., absorb few rays when covering the receiving-plate, cause but a feeble sound. On the other hand, bitumen, India-ink, platinum-black, lamp-black, etc., greatly augment the intensity. The best receiver found was a plate of thin mica with the blackened face toward the ear. The influence of the surface is shown especially by coating thin paper or cloth with lamp-black, which produces a strong sound, though without the lamp-black scarcely any effect is noticed.

It follows that radiophonic sounds result from the direct action of radiations on the receiver. By varying the amount of the rays received by diaphragms, the intensity changes; and by using polarized light, with a crystal of tourmaline for a receiver, variations of intensity are noticed, when the polarizer or analyzer is rotated, corresponding to the variations in the amount of the rays transmitted.

M. Mercadier produced radiophonic effects, not only by the light of the sun and that of the electric lamp, but also by the lime-light, the petroleum-lamp fed with oxygen, an ordinary coil-oil lamp, a gas-jet, and a hot spiral of platinum wire. There seems to be no difference, except in intensity, among the sounds produced by these different sources. M. Mercadier shows that "radiophonic sounds are chiefly produced by those radiations of great wave-length which are known as calorific rays." Using a gas-jet, and interposing plates of colored glass between it and the wheel, he finds that but little effect is produced by the red glass, while the green diminishes the intensity of the sound to a certain extent, and the blue diminishes it very much more.

Using the rays of the spectrum of the electric light, and concentrating isolated portions upon the instrument, no sound was heard from the extreme violet to the yellow of the spectrum, but the orange rays first produced an effect. The intensity of the sound increased in the red, and reached a maximum in the obscure rays beyond the red, then decreased very rapidly. Radiophonic effects are therefore produced principally by the red and ultra-red rays, that is to say, by rays of great-wave length. This conclusion was still further verified by using as a source of heat a dish of copper heated by an oxyhydrogen jet. The sounds were clearly produced, even after the jet was extinguished, and gradually diminished in intensity as the copper plate cooled off.

C. R. C.

On the Influence of Temperature on the Musical Pitch of Harmonium Reeds. By Alex. J. Ellis: Paper read at the Royal Society, February 3, 1881. Notice in *Nature*, February 17, 1881.—The author shows, by observations on Appunn's reed-instrument, that the pitch of such reeds is affected by temperature to the amount of one vibration in ten thousand per degree Fahrenheit, the reed being flattened by heat, and sharpened by cold. This is about twice the change sustained by a tuning-fork from the same cause.

C. R. C.

Physiology of the Eustachian Tube. By Dr. Fournié (*Congrès de Reims*): *Revue mensuelle de laryngologie, d'otologie, et de rhinologie*, No. 3, Vol. I., October, 1880.—1. The Eustachian tube is always open and in direct communication with the air of the pharynx.

2. The tubal muscles (the peristaphylinus internus and externus, and the pharyngostaphyline fascia) are intended by their contraction to shut, and not to open the tube.

In reply to those who hold that the permanent patulence of the tube must be dangerous for the membrana tympani, and at the same time a bad condition for hearing, because of the incessant penetration of sonorous waves into the middle ear by the Eustachian tube, M. Fournié made the following experiments:

He showed that, by means of tubes varying in their inside diameter from 1 to 4 mm., the ticking of a watch easily heard through the tube of 4 mm. in diameter was not heard through the narrowest tube. Hence, the Eustachian tubes being of about the latter small measure in diameter, it follows that the sounds produced in the body, of the voice and others, are not heard through the Eustachian tube. In a second experiment Fournié showed, by an arrangement of retorts and capillary tubes, that ordinary burning-gas, even when under some pressure, does not pass through a capillary tube, if this latter is closed at one end. Hence, as this is the condition in the middle ear and Eustachian tube, the latter being a capillary tube closed at one end, no fear need be entertained that violent expiratory movements can endanger the membrana tympani, even admitting that the tube is always open. This same experiment proves that air cannot press through the Eustachian tubes excepting under certain pressure, and as such pressure can be exercised only by the tubal muscles, it follows, according to M. Fournié, that these muscles exercise a constrictive influence on the tube, and a dilating one, as is generally held.

Aural Diseases and their Relations to Diseases of the Uterus. (Des affections auriculaires et de leurs rapports avec celles de l'utérus.) I. Baratoux: *Revue mensuelle de laryngologie, d'otologie, et de rhinologie*, No. 1, Vol. I., August, 1880, Bordeaux.—This work is divided into seven chapters, as follows: 1. Aural diseases at puberty. 2. Aural diseases appearing periodically with the menses. 3. Diseases of the ear at the menopause. 4. Diseases of the ear supervening upon pregnancy. 5. Diseases of the ear supervening upon acute diseases connected with the menstrual flow. 6. Difficulties in hearing consecutive to uterine affections. 7. Aural maladies inducing difficulties in menstruation.

In the above-named chapters we fail to see anything that has not been observed by all aurists, and which are not to be considered as very much more than *post hoc* rather than *propter hoc*. In fact, we have long considered the slight difficulties of hearing which sometimes appear in females already diseased in their ears, during menstruation, as far more important than the slight relapses which may occur in any aural patient during any intestinal derangement. As for the point maintained by the author in Chapter VII., that a reciprocity exists between the uterus and the ears, so that uterine maladies may be induced by aural diseases, we regard it as purely fanciful on the author's part, and therefore far from proven. Reflex neuroses probably exist between all parts of the body, as all are more or less correlated areas through the sympathetic system, and, in so far as the author of this brochure brings that fact before the mind of the profession, the better it is for the patients; but we must all beware of proving too much, or we shall keep truth forever "at the bottom of the well."

Foreign Bodies in the Ear. By Dr. E. J. Moure: *Revue mensuelle de laryngologie, d'otologie, et de rhinologie*, No. 3, Vol. I., October, 1880.—In this paper the author gives an account of foreign bodies in the ear, and the means for removing them, the use of the syringe being justly preferred by him.

Three cases occurring in his own practice are given, viz.: a small shell in the ear of a child nine years old; a grain of wheat imbedded in cerumen in the ear of a child five years old; and a pearl shirt-button in the ear of a child thirteen years old, all of which were successfully, quickly, and painlessly removed by syringing with warm water.

On the Movements of the Musculus Tensor Tympani in the Dog. Bockendahl: *Archiv für Ohrenheilkunde*, Vol. XVI., Part 4—From a series of interesting, original, and carefully conducted experiments, Bockendahl draws the following conclusions:

1. The muscular tensor tympani in both the dog and cat is an active factor in hearing, from its influence on the tension of the membrana tympani.
2. Its action produces chiefly a revolution of the hammer, and a consequent increased tension of the two unequal halves of the membrana tympani; the axis of revolution is almost parallel with the manubrium mallei.
3. Every tone is responded to by a contraction of the muscle, which can be recognized, directed upon the muscle itself, and also at the point of insertion of its tendon upon the bone.
4. The intensity of the tone exercises an increasing influence on the contractions of the muscle.
5. The higher tones are responded to by greater contractions of the muscle than lower tones.
6. With continuous tones a tetanus of the musculus tensor tympani is produced.

The Cochlea of the Ornithorhynchus Platypus compared with that of Ordinary Mammals and of Birds. By Urban Pritchard, M.D., F.R.C.S., Aural Surgeon of King's College Hospital: Read before the Royal Society, London, December 9, 1880, by Professor Huxley, Sec. R.S.

(Abstract.)

General form of the cochlea of the duckbill or ornithorhynchus.—This cochlea consists of a somewhat curved tube, about a quarter of an inch (6.3 mm.) in length, and one-twentieth of an inch (1.26 mm.) in diameter, projecting forward from the cavity of the vestibule and embedded in the substance of the petrous bone. It is nearly horizontal, and is slightly curved outward.

In section the tube is first oblong, with its greatest diameter from top to bottom, then somewhat triangular, and finally oval, with its greatest diameter from side to side. It terminates in a slightly enlarged rounded extremity, flattened from top to bottom.

Comparison with typical mammals and birds.—In general form the duckbill's cochlea closely resembles that of the bird, and is very different to the spiral cochlea of the ordinary mammal. The two first differ, however, in that the duckbill's is more curved, and curved outward instead of inward, as in the bird. The enlarged apex of the former is rounded, that of the bird oval. The typical mammalian cochlea-tube differs from that of the duckbill, in being spiral instead of merely curved, in tapering from commencement to apex, and in being much longer. Lastly, the axis of the spiral cochlea is horizontal, whereas that of the curved one is vertical.

The internal arrangement and minute structure of the duckbill's cochlea.—The interior of the tube is divided horizontally into two scalæ by a partition, the inner portion of which is thick and bony (lamina ossea): the outer, thin and membranous (lamina membranacea); a third scala is formed by a delicate membrane (membrane of Reissner) proceeding from the upper surface of the lamina ossea to the inner[1] wall of the tube.

The upper and larger division is the scala vestibuli, and this communicates posteriorly with the vestibule; the lower is the scala tympani. These two are united at the apex of the cochlea by means of an oval opening, helicotrema. The third, a small triangular tube, is the ductus cochleæ, or scala media, and this constitutes the membranous labyrinth; it contains the endolymph, and is entirely separate from the other two scalæ, which contain the epilymph. The ductus cochleæ is lined with epithelium; the scalæ vestibuli and tympani with endothelium.

The lamina ossea is a wedge-shaped mass of modified bone attached to the lower part of the outer wall and the outer part of the floor of the tube. Its inner free margin presents a deep groove (marginal sulcus), the lower lip of which projects farther inward than the upper. The lamina ossea does not extend to the apex of the cochlea, and thus allows of the communication between the scalæ vestibuli and tympani.

The ductus cochleæ is triangular in section, the floor is formed by the inner portion (limbus) of the lamina ossea and a strong membrane (membrana basilaris), which stretches from the lower lip of the sulcus to a mass of connective tissue (ligamentum cochleæ) adherent to the inner wall of the cochlea. The inner wall of the ductus is formed of this ligamentum cochleæ; and the outer wall, or sloping roof, by the delicate membrane of Reissner, which springs from the upper surface of the limbus, and is attached to the upper part of the ligamentum cochleæ.

The membrana basilaris is composed of three fibrous layers: the lower, longitudinal; the middle, transverse; and the upper, formed of very fine trans-

[1] In describing the position of the parts in the duckbill's cochlea, the median line of the body is taken as the centre; in the spiral cochlea, the modiolus or axis.

verse fibres. There are two blood-vessels running longitudinally in the lower layer.

The ligamentum cochleæ is a somewhat triangular mass of connective tissue with numerous blood-vessels, which in its upper portion run longitudinally, and, with the epithelium, form the stria vascularis.

The membrane of Reissner is composed of a delicate basement-membrane, with the endothelium of the scala vestibuli on its upper surface, and epithelium on its under surface; here and there blood-vessels may be traced on it, running from the limbus to the ligament, and in some places these vessels form convoluted knots.

The epithelium lining the ductus cochleæ varies according to its position: that lining the membrane of Reissner is composed of a single layer of hexagonal cells; in the sulcus they are rounded: on the inner part of the membrana basilaris and the lower portion of the ligament they are cuboid; on the upper part of the ligament they are very peculiar, and resemble the transitional variety closely packed together. In the deeper part of the layer run numerous longitudinal blood-vessels, and this forms the already mentioned stria vascularis. The remaining portion of the epithelial layer that lies on the lower lip of the sulcus, and on the outer portion of the membrana basilaris, is developed into the so-called organ of Corti.

This organ of Corti consists of a double row of rods (of Corti), united at their upper ends and separate below; they stand on the membrana basilaris, and with it form a triangular tunnel.

The rods of both rows have cylindrical shafts and enlarged extremities; the upper ends of the inner row are rounded, and fit in corresponding concavities of the outer row. A delicate process projects inward from the upper part of each of the rods, the processes of the outer ones lying above those of the inner.

Rows of hair-cells are arranged on either side of these rods—one [1] to the outer side and three to the inner. Below the three inner rows are situated rows of nuclear cells (cells with well-marked nuclei, but no regular cell-wall)—the cells of Deiters. Lying on the lower lip of the sulcus is a small mass of nuclear cells, and there is a row of these cells at each of the lower angles of the triangular tunnel.

The inner and outer side of the organ of Corti is formed of modified columnar cells. A reticulate membrane covers the rods and hair-cells, the hairs of which project through certain circular meshes of the membrane.

Covering the limbus, crossing the sulcus, and covering the organ, is a mucoid layer, the membrana tectoria.

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[1] Since presenting this communication I have discovered a second row of hair-cells in this position.

Nerve-filaments pierce the upper lip of the sulcus and pass to the hair-cells and nuclear cells of the organ.

The organ of Corti, with the membrana basilaris below and the membrana tectoria above, form the lamina membranacea.

The ductus cochleæ commences as a delicate tube, no doubt connected in some way with the saccule of the vestibule. Its termination is very peculiar: instead of ending with the lamina ossea, where the organ of Corti ends, it is continued around the apex of the cochlea to form three-fourths of a circle. Just past the end of the lamina it forms a circular tube; at the other side of the apex it enlarges into an oval chamber (lagena) which terminates at the base of the lamina ossea. This lagena is lined by epithelium, chiefly cuboid, but with one large patch of nerve-epithelium, like the thorn-cells and bristle-cells found in the maculæ acusticæ of the vestibule (*Quar. Jour. of Micros. Science*, p. 379, 1876).

The cochlear branch of the auditory nerve passes through the bone on a level with the floor of the tube, but to its outer side. It gives off lateral branches all along to the lamina, and its terminal fibres go to the lagena. The lateral branches pass through a ganglionic mass, similar to the ganglion spirale, and then on through the lamina, close to its lower surface, finally perforating the upper lip of the sulcus by a single row of holes (habenula perforata) and entering the organ of Corti as already described.

Comparison of the minute structure of the cochlea of the duckbill with that of typical mammals.—From the foregoing description the duckbill's cochlea is shown to be so unmistakably mammalian in type that merely the differences will here be noted.

The lamina *spiralis* membranacea increases in width, and so do its component parts, from base to apex of the spiral cochlea; in the duckbill's this widening takes place, but not nearly to such an extent as in the spiral cochlea.

The rods of Corti in the duckbill are not so well developed as in the typical mammal.

The membrane of Reissner in this monotreme presents blood-vessels on its surface with convoluted knots; these I have never found nor read of in this situation in any other mammal. The vas spirale of the ordinary mammal is represented by two vessels in the duckbill.

The course of the cochlear nerve necessarily differs in the two forms of cochlea.

But the great difference is found in the presence of the lagena at the end of the duckbill's ductus cochleæ; this has never been found in mammals, but is found in birds, reptiles, and amphibians.

Comparison with the bird.—A brief description of the bird's cochlea will be found in my paper, *in extenso;* in this abstract I propose only noting the similarities and dissimilarities.

The scalæ tympani in each type of cochlea correspond.

There is no scala vestibuli in the bird, the scala media (ductus) occupying the whole of the upper division of the tube.

The membrane of Reissner and stria vascularis is represented by the tegumentum in the bird.

The lamina ossea corresponds to the quadrilateral cartilage, and the ligamentum cochleæ to the triangular cartilage of the bird.

There are no rods of Corti in the bird; the hair-cells are more numerous, and their component hairs are united together into a spine.

The nerve-fibres pierce the quadrilateral cartilage by numerous rows of holes, instead of one row, as in the duckbill and other mammals.

The lagena, with its macula acustica, is found both in the bird and duckbill, but in the former is a direct continuation of the ductus, whereas in the latter it is connected by means of a constricted tube. Moreover, the ductus of the duckbill makes three-fourths of a turn, but that of the bird is nearly straight.

General conclusions arrived at by the research.—Although the outer form of this monotreme's cochlea resembles that of the bird in being nearly straight, yet its internal arrangement is decidedly mammalian.

The general acoustic apparatus of the duckbill's cochlea is not nearly so extensive as that of the ordinary mammal, nor is its organ of Corti so well developed.

Lastly, the duckbill's cochlea possesses an addition, the lagena, which is not found in any other mammal, but which is found in the bird, reptile, and amphibian. Thus it presents a distinct link between the cochlea of the higher mammals and that of the lower vertebrates.

In conclusion, I desire to give my most hearty thanks to the many Australian friends who, by their zeal in my cause, have provided me with specimens of the ornithorrhynchus in such a good state of preservation as to allow of their microscopic preparation and examination.

Ivory Exostosis in both Ears Successfully Removed by Operation. George P. Field: *The Lancet*, Jan. 8, 15, 1881.—Mr. Field, who has already reported the removal of these growths from the ear by means of the dental engine, has again given to the profession his interesting experience in these difficult cases. It is the opinion of this otologist that this instrument is the only one which will penetrate with any certainty such pre-eminently hard and unyielding growths of the petrous bone. In the case formerly reported he operated seven times on large ivory growths completely filling both ears, the patient being seven hours under chloroform and ether. The density of these tumors can scarcely be imagined unless one has actually drilled into them.

These tumors were considered by Toynbee as depending entirely upon the gouty and rheumatic diatheses. Other authorities, among them Tréquet, think they are only to be found in syphilitic subjects; and Gruber believes such dis-

cases may influence their production. Mr. Field himself has, in no single instance, discovered a trace of gout or syphilis in any of his cases, but he rather believes that they are often due to a chronic inflammation of the walls of the external meatus, such as might be produced by sea-bathing. In both of his cases of double ivory exostosis the patients were in the habit of bathing constantly day after day in the sea, and they both attributed their ear-mischief to this cause alone. In confirmation of this theory the aquatic habits of the Hawaiian islanders are instanced as influencing these growths, a fact pointed out by Dr. Clarence J. Blake (quoting from Professor Wyman), who has described, in a paper published in this journal, a number of the crania of these people, where exostoses were found in the external auditory meatus.

Von Tröltsch says that considerable pain is always felt in these tumors when they are touched; Mr. Field has not found this to be the case in his own experience. He says they usually occur bilaterally, are covered with white, smooth skin, and are hairless; they are of ivory consistency, and arise near the orifice of the meatus. Such growths—true ivory exostoses—in other parts of the body would be called hyperostoses. Their development is insidious, and they occur in apparently healthy organs. Their very existence is not suspected until the patient discovers that his hearing is rapidly failing him, while the absence of pain might lead him to regard it at first as a trivial matter.

Mr. Field continues, quoting: "The ivory exostosis has been observed to be much more common in men than in women. It arises from a broad base in the posterior wall of the external meatus, either as a long, bony ridge, or as a normal tumor or tumors. This form is acquired, and not congenital. Its growth is not rapid, nor have we often any signs of inflammation until the patient becomes suddenly deaf from the complete occlusion of the meatus and consequent irritation set up thereby." The pedunculated form of exostosis, on the other hand, is rapid in growth, and the suppuration is plentiful and very offensive.

When ivory exostoses are multiple, they do not, as a rule, cause a great amount of deafness. They are not confined to the posterior wall—three of them are often found growing from opposite sides, and they become so wedged into one another that they cannot close up altogether, and a triangular space is therefore left between their apices. They are usually found nearer the membrana tympani. As regards the return of these growths—true ivory exostoses—Mr. Field states that in the case operated upon by him three years ago there has been no return of deafness. The case now under review is similar in almost every particular to the one just alluded to. The patient was a gentleman in good health, but complained of severe deafness, attributable to a compact growth of bone filling up both ears. He stated that as long as he could remember he had suffered from earache from time to time.

In 1866, when a midshipman in the Royal Navy, he first observed he was becoming deaf, and began to suffer increasing pains in the ears, but does not

remember ever having any discharge from them. He attributes his deafness to sea-bathing, and states that at times in hot climates "he almost lived in the water." Deafness in this case finally became so great that he was obliged to leave the service, and in 1879 he placed himself under the care of Mr. Field. Both ears were now closed by a bony growth, which, on examination, proved to be a large ivory exostosis, and in each ear they were found to arise from the posterior wall of the external auditory meatus. The chief symptoms were the distressing feeling of fulness and pressure in the ears, and the deafness. (The only test made of the hearing-power was with the watch, which was heard on contact with the right ear and two inches from the left.) He had tinnitus aurium. The growths filled up both ears, extending from about a quarter of an inch from the orifice to within a short distance of the tympanic membrane. On January 29, 1880, the patient was placed under chloroform, and with the "American" dental engine Mr. Field proceeded to drill through the growth in the right ear. The help of three assistants was found to be necessary in performing this operation—one to give chloroform, one to work the treadle of the engine, and one to hold the steel guard in the ear, which is used to prevent any risk from the slipping of the drill when in motion. Help is also required to sponge and to syringe with cold water, to keep away the blood which fills up the meatus with great persistency, and often prevents, for a time, a view of the bone. After fifty minutes' steady drilling he succeeded in getting a fine drill through the growth. The greatest caution was found to be necessary to prevent injury to the ear. On February 11th the opening was enlarged, the patient being forty-five minutes under chloroform. On March 2d he operated for fifty-five minutes on the left side in a similar way, and in this ear two subsequent operations were necessary—one on March 24th, lasting forty minutes, and one on April 17th, half an hour.

The method of procedure in the operation was as follows: The patient was placed on a high couch four feet from the ground, with his head resting on a pillow, and the side to be operated on must be propped up toward a good light. The patient was placed at this height because the dental engine is adapted to a high chair, and the cable through which the power is transmitted to the drill will not reach an ordinary sofa. After chloroform has been administered an assistant holds a steel guard in position around the growth, the guard having been made beforehand to fit the exostosis. Mr. Field had a guard made for his operations, of soft copper, very thin, and small enough to pass between the growth and the anterior wall of the meatus; one end was fitted to pass behind the growth of the right side, and the other end to pass behind and fit the left exostosis. When the shape of both guards has been thus obtained by actual measurement, a steel one is made for the operation. Mr. Field generally begins with a small drill, and subsequently enlarges the opening with a larger instrument. It is not necessary to previously cut through the skin, for the drill may be used for that purpose. A small hole is first

made by the side of the steel guard, avoiding the base of the tumor, as there is nothing to indicate the direction, and a slip would be attended with the utmost danger to the life of the patient. The blood, notwithstanding all precautions, will be sure to fill up the meatus; even if successful in perforating the the base of the tumor, the operator may find himself in a very unexpected and unenviable position. Mr. Field has found it best to work very slowly, constantly taking out the instrument to sponge or syringe away the blood, and thus for an instant or so get a view of the bone. The operation, as may be seen by the description, is necessarily very tedious, and by no means an easy one; with the greatest care unforeseen *contretemps* may arise. Mr. Field is very particular to impress upon the reader the importance of having several assistants at hand; in his last operation on the left ear one assistant was absent, and, having to hold the guard himself while directing the drill, the former slipped, the membrana tympani was injured, and slight facial paralysis was set up. The facial nerve must have been injured by the instrument, which probably penetrated the wall of the tympanum and the aqueduct of Fallopius. The paralysis was cured, a part of the treatment consisting in the use of galvanism, and the perforation in the membrane closed.

Mr. Field regards the operation as one of extreme difficulty, and adds that any serious complication in carrying it out adds largely to one's anxiety. The patient afterward did remarkably well, and regained his hearing in both ears.

The records of the above case are full of interest, and the frank relation of every mistake is much to the credit of the writer, and greatly increases the value of his work.

Case of Perforation of Membrana Tympani from Ascaris Lumbricoides. Lewis W. Reynolds: *Lancet*, October 23, 1880.—The reporter was called to see a woman, aged thirty-five years, three or four months advanced in pregnancy. She had vomited several round worms, and some had also been discharged from the nostrils; subsequently others were passed per rectum. Santonine, followed by compound scammony powder, was administered, and a great many more were passed per rectum. Three or four hours after taking the medicine, and after having previously suffered all night from intense earache, a worm was discovered protruding from each ear, and both ears were bleeding; subsequently others came away from the ears; one of them was four inches long, with the diameter of a small goose-quill. Two weeks after the first visit the doctor was called and found her perfectly insensible, having been so for about six hours; she was roused again, however, the attack appearing to be hysterical, and gradually improved in health.

The last report of this case was about a month subsequent to the above, when blood was found to have been trickling from her ears and down her throat for several days; the latter was coughed up. The *meatuses* were excoriated, and a large perforation was said to exist in both membrana tympani;

the sense of hearing was but little impaired. Dr. Reynolds believes that the membranes were perforated by the passage of the ascarides; he considers that, in addition to being vomited, some must have crawled up the œsophagus into the fauces, thence some found their way into the nasal passages, and others into the Eustachian tubes, perforating the tympanic membranes, and being discharged by the external auditory meatus.

The Removal of Foreign Bodies from the Ear. Editorial: *Lancet*, November 13, 1880.—The editor asserts that "the danger of using instruments for the removal of foreign bodies in the ear cannot be too much insisted on or too constantly borne in mind." Further, he believes that "in no case whatever should any instrument be employed until a thorough prolonged trial of well-directed syringing has been made and found to fail." The reviewer fails to see why the "well-directed" use of instruments is attended with greater danger than well-directed syringing. Evil results from syringing are by no means infrequent; but, however great the injury thus done, the operator feels safe in retreating behind statements similar to those quoted. The syringe is a most dangerous instrument in unskilful hands, and it may be stated that any untrained manipulator can seriously injure the ear in attempting, by any method, the extraction of foreign bodies, and it would, therefore, be the safest plan for him to let them alone. It is very seldom, indeed, that a foreign body, when introduced into the ear, causes any injury before efforts at extraction are commenced.

Two Cases of Fracture of the Skull in Children aged Six Years. Salford Royal Hospital, under the care of Mr. Walmsley: *Lancet*, October 9, 1880.—Fracture of the base of the skull, at the early age of six years, has rarely been reported, although the frequency of falls from a considerable height is one of the experiences of the childhood of a large class of people. The first case of the two instances referred to was that of a male child, who fell down-stairs, a distance of about eight feet. He was somewhat unconscious when seen, and there was copious bleeding from the right ear, followed on the next day by the discharge of sero-sanguineous fluid in large quantities. On the second day after admission to the hospital, bilateral convulsions appeared, recurring at intervals during the day, and on the following day the discharge from the ear was more profuse, the convulsions appeared more frequently, and about mid-day he died. The post-mortem examination revealed a fracture across the middle fossa of the base of the skull and of the petrous portion of the temporal bone; there was also a fissured fracture of the frontal bone, extending to the coronal suture on each side. A large clot of blood was effused between the bone and the dura mater at one point.

The second case was admitted on the same day as the previous case; he was in an unconscious condition, having fallen off a swing. There was a free

and copious bleeding from the left ear, with paralysis of the facial muscles on the same side. On the following day the child had recovered consciousness but remained somewhat stupid for some days longer. The serous discharge from the ear, which had been very profuse, ceased on the second day, and on the sixth day the child was bright and sharp. He left the hospital in about five weeks after his admission, perfectly well, with the exception of the facial paralysis, which still remained. The hearing of the left ear, it is stated, was not affected by the injury.

Case of Partial Deafness Cured by an Attack of Typhoid Fever. E. F. Wells, M.D.: *Lancet and Clinic*, December 4, 1880.—This interesting case was a farmer, forty-five years of age. It is stated that he always had been deaf to ordinary conversation, but that he could hear the voice when loud and spoken directly into the ears. During the autumn of 1880 he had a severe attack of typhoid fever, with delirium and a tendency to coma; there was also increased deafness. After convalescence began it was observed that his hearing was normal, both as regards conversation and sounds of high pitch, such as the ticking of a clock or a watch. The interest in this case, it seems to the reporter, if the observations were correctly made, lies in the probable effect of the disease on the middle ear. Although a remedy of this nature is not available in treatment, the result suggests the possibility of our being able to induce beneficial changes by the aid of drugs alone in certain cases.

Effect of Quinine on Hearing. Remarks by H. N. Spencer and others, St. Louis Medico-Chirurgical Society: *St. Louis Courier of Medicine*, November, 1880.—Dr. Spencer, who has taken great interest in the subject of the influence of quinine upon the circulation, said that some years ago he had made some experiments, giving large doses (eighty grains) of quinine to a gentleman then attending medical lectures, and studying the effect upon the circulation, especially of the ear. In a few minutes there was general congestion of the vessels of the membrana tympani, which gradually subsided. There was deafness and tinnitus, which disappeared as the influence of the drug passed off. No unpleasant effect followed from the large doses taken. The case was kept under observation for some three hours after the administration of the medicine, and the membrana tympani resumed its natural appearance gradually without any appearance of anæmia succeeding to the hyperæmia. Dr. Spencer said that patients continually ascribe deafness and tinnitus to the use of quinine, and it is impossible to determine in what proportion of cases this is really the cause of their troubles. He believes it possible that, in some cases, the quinine has a permanent injurious effect upon the hearing, just as vaso-motor disturbances from other causes than quinine may produce such effects. Some persons are specially susceptible to such influences. Dr. Spen-

cer, however, believed that he had seen no case of permanent deafness that could be entirely attributed to this cause; he had always found other causes sufficient to account for the condition existing.

Compound Fracture of Petrous Bone, Caused by Revolver-Bullet—Bruising of the Brain—Meningitis—Death. Under the care of E. M. James, Melbourne Hospital: *The Australian Medical Journal*, September, 1880. —The patient was a man, twenty-five years of age, who had shot himself on July 24th, in the right ear, with a revolver. After the infliction of the wound, he staggered a few steps and then fell, and there was severe primary hemorrhage. On examination there was found to be a lacerated wound at the bottom of the concha of the right ear, involving the external auditory meatus; the parts around were considerably blackened with powder; blood was oozing freely from the external wound. The patient appeared dazy and drowsy, keeping his eyes closed, but opening them languidly when disturbed; if roused, he answered questions, but evinced much irritability; his speech was muffled, the right side of the mouth not moving in articulation; the mouth itself was slightly drawn to the left side; the right cheek puffed during every expiration; there was marked hyperæsthesia about the lower part of the neck and shoulders, especially on the right side, the patient crying out every few seconds from pain; the pupils were dilated, but responded readily to light; the motions of the limbs were not impaired. The patient prayed that the bullet might be removed, as his sufferings were terrible. Mr. James could not detect the bullet when he passed a probe into the meatus externus, but dead bone was everywhere detected in the neighborhood of the tympanum; he concluded that the bullet had probably passed into the interior of the cranium. The administration of chloroform was then commenced, and it was at once discovered that there was perfect anæsthesia of the conjunctiva covering the right eyeball. Mr. James made a crucial incision behind the right ear, and trephined from behind forward through the upper part of the mastoid process on to the point of a probe inserted through the original wound, the trephine being removed, with the circle of bone included, directly the probe was reached. It was now found that the bullet could not be distinguished, and therefore it was determined to not make any further search. On the following day the patient was quite sensible, and complained greatly of the pains in the injured ear and the shoulders; the pulse was 84, the temperature 100°. During July 26th, 27th, and 28th the fever increased, the temperature gradually running up to 105°. There was still sensibility, but occasional delirium. The pulse was 85 to 90. He was intolerant of light and sounds. On the 29th, 30th, and 31st the temperature continued to rise, and on the morning of the last day it reached 108°; it fell rapidly after this to 101°, and in less than an hour he died. The pulse on the 29th was 84, no report of its condition was made after that date. Toward the last there was much discharge from the ear, and also

less sensitiveness to sounds. At the post-mortem examination, which was made by the pathologist, Dr. Allen, a bullet weighing nearly a quarter of an ounce was found to have passed through the concha of the right ear, involving the external auditory meatus; it then penetrated the skull, and, running inward, had struck against the base of the petrous bone, which was fractured transversely near its outer extremity, and more or less separated from all its usual connections; the anterior part of the bone was also splintered off longitudinally. When the dura mater was removed, the petrous bone was readily movable upon the adjacent osseous structures. The ball itself was firmly fixed in the floor of the tympanum, the walls of which were largely destroyed, while its roof was broken into small fragments, so that when the dura mater was removed there was a gap in the floor of the middle fossa of the skull nearly half an inch in diameter. On the outer surface of the detached petrous bone the projecting promontory of the inner (?) ear was discernible.

The dura mater was not perforated, but was detached from the injured bone, being separated from it by a mixture of lymph and extravasated blood. There was no blood in the arachnoid cavity. On the under aspect of the right middle lobe of the cerebrum was an area of softening an inch and one-fourth in diameter and three-fourths of an inch deep; the brain-tissues in this situation were purplish black and pulpy, and could be easily scraped away, leaving a defined boundary wall of brain-substance of yellowish color, but of firm consistence. Around this principal centre of injury were three small points of bruising, which had not yet softened; two were situated between the point of the middle lobe and the crus cerebri, while one was farther back, near the flocculus. The tissues at the site of the main lesion had evidently been contused and subsequently inflamed. The inflammation had spread inward and forward along the base of the brain, the pia mater being thickened by exudation of lymph into its substance; there was a considerable quantity of serous fluid in the arachnoid at the base of the brain.

There was a trephine-wound leading from the upper and back portion of the mastoid bone, half an inch behind the point of entry of the bullet, and passing forward into the cavity in the floor of which the bullet was firmly embedded. Even when the bones were thoroughly exposed the bullet was with difficulty recognized, and some degree of force was necessary to dislodge it. The trephine wound formed a dependent opening to the cavity in which the ball lay. The cause of death was meningocerebritis consequent upon a compound fracture of the skull, attended with bruising of the brain.

Otitis Media, and Otitis Media Purulenta Acuta, Caused by the Use of the Galvano-Cautery in the Naso-Pharynx. W. H. Daly: *Transactions of the American Medical Association*, 1880.—Dr. Daly reports, in a paper read before the Section on Ophthalmology, Otology, and Laryngology, that in two instances there occurred in his own practice an inflammation of the middle ear

from the use of the galvano-cautery in burning the naso-pharynx. In one of the cases, otitis media (acuta?) of a serious nature occurred from the operation for removing a growth from the vault of the pharynx, attributed to the accidental burning of the rim of the Eustachian orifice. In the other case reported, otitis media purulenta (acuta?) was caused in the ear opposite from the nostril in which an operation was performed, and was attended with symptoms of so serious a character as to threaten the life of the patient. The author of the paper expresses the belief that the aural complication in the case last mentioned occurred through the conduction of a either nerve or line of lymphatics leading from the parts operated upon to the middle ear, or from the passage of superheated air from the pharynx to the tympanum. There are no details given; the facts, however, should serve as a warning to those who treat affections of the naso-pharynx with cauterizing agents.

Examination of the Hearing of Two Hundred and Sixty-seven Children. Weil, Stuttgart: *Monatschrift für Ohrenheilkunde*, December, 1880.—The statistics obtained by Weil from the examination of two hundred and sixty-seven children in a foundling institute offer some points of interest, although the numbers are not as large as could be wished.

Of 267 children, 214 were boys and 53 girls:

15 years old	1
14 "	14
13 "	40
12 "	31
11 "	47
10 "	57
9 "	9
8 "	29
7 "	8
6 "	3

Had had scarlet fever	25
" diphtheria	2
" measles	66
" measles and scarlet fever	23
" scarlet fever and diphtheria	4
" measles and diphtheria	5
" measles, scarlet fever, and diphtheria	20

Hence 122, or 46 per cent., had not suffered from the diseases of childhood.

Eighty-seven were unable to hear a whisper eight metres, and were considered deaf; 58 of these were deaf on both sides, 23 only on one side.

Of the 122 who had never had children's diseases, as above, 34, or 27.8 per cent., were deaf; 29 on both sides, 5 on one side.

Of the 145 who had had children's diseases, 47, or 31.8 per cent., were deaf, 4 per cent. more than the preceding class.

Of 14	who were	14	years old,	9	were deaf,	or	64.2	per cent.
40	"	13	"	17	"		42.5	"
31	"	12	"	13	"		41.9	"
47	"	11	"	12	"		25.5	"
57	"	10	"	15	"		26.3	"
37	"	9	"	8	"		21.6	"
29	"	8	"	6	"		20.6	"
8	"	7	"	1	"		12.5	"

An increasing percentage with advancing years, and, so far as the figures go, a refutation of the popular idea that ear-diseases heal of themselves.

Of the 81 deaf children, 15 had collections of cerumen, 17 subjective noises, 22 pain, 4 calcifications, 6 had had suppuration, and 4 still had suppuration.

Thirty per cent. of all the children, therefore, heard badly.

Foreign Body in the Ear—Death in Consequence of Repeated Attempts at Extraction. (Corpo extranho de ouvido. Morte em seguida a tentativas repetidas de extracçâs): *O Correio Medico de Lisboa.* 10. No. 2, January 15, 1881.—The *Union médicale* reports the following interesting case from the *Imparziale:*

A man, forty-one years of age, felt a piece of stone in the right car. Several surgeons made attempts to extract it without previous examination of the parts; but while doing their utmost for extraction, convulsions took place, speedily followed by paralysis. The patient suffered subsequently from otorrhœa and repeated hemorrhage from the tuba Eustachii and the external auditory canal.

Three weeks after he died of septicæmia. At the post-mortem there were found metastatic abscesses in the inferior lobes of both lungs and in the muscles of the right lower limb. In the auditory canal was a fetid and voluminous pus. The integuments of this canal were lacerated and covered with a pultaceous secretion and granulations. The periosteum was loosened from the bone, which began to show signs of caries. The membrana tympani, deprived of its osseous connection, was pushed backward to the orificium of the tuba, and the handle of the malleus touched the oval window. All the walls of the labyrinth were denuded. At the level of the point where the chorda tympani leaves the facial canal was an irregular opening communicating with the canal; the chorda tympani was lacerated at the level of the fissura Glaseri. There also was an oval opening of half a centimetre diameter at the fundus of the tympanic cavity, at the level of the jugular vein. In the internal wall of the latter vessel was a yellowish discoloration to an extent of nearly five millimetres, infiltrated with pus. *But the piece of stone was nowhere to be found.*

J. J. B. V.

BIBLIOGRAPHICAL INDEX.

Books.

"Phonetik, Zur Vergleichung der Physiologie der Stimme und Sprache." F. Techmer, 8vo, Leipzig, 1880.

"Suites d'études d'otologie. Leçons faites à l'école pratique de la Faculté de Paris (1875 à 1880)." 8vo. Gellé, Paris, 1881.

"On Deafness, Giddiness, and Noises in the Head." Second edition, enlarged and revised. Edward Woakes, London. Pp. 224. Reprint, Presley & Blakiston, Philadelphia, 1880.

"The Forms, Causes, and Treatment of Tinnitus Aurium," W. Douglas Hemming (reprint 7 pp.): British Med. Journal Press.

"Hygienic and Sanative Measures for Chronic Catarrhal Inflammation of the Nose, Throat, and Ears." Part I., pp. 166. Thomas F. Rumbold, St. Louis. George O. Rumbold & Co., St. Louis, 1880.

"Proceedings of the Fourth National Conference of Principals of Institutions for Deaf-mutes." Northampton, Mass.

Journals.

External Ear.

"The Removal of Foreign Bodies from the Ear," editorial: Lond. Lancet, Nov. 13, 1880.

"Foreign Bodies in the Auditory Meatus," Notes on current topics: Med. Press and Circular, Nov. 10, 1880.

"A Case of Perichondritis Auriculæ," H. Knapp: Trans. Am. Medical Assoc., 1880.

"Ivory Exostoses in Both Ears Successfully Removed by Operation," George P. Field: Lond. Lancet, Jan. 8, 15, 1881.

"Aspergillus Nigricans," E. N. Rush: Med. and Surg. Reporter, Jan. 1, 1881.

"Des corps étrangers de l'oreille," Roustan: Montpel. méd., XIV., 312, 1880.

"Rapport sur un travail du Dr. Roustan, intitulé: Corps étrangers du conduit auditif," Desprès: Bull. soc. de chirurgie, VI., 566. Paris, 1880.

"Otitis parasitica (aspergillina)," P. N. Pipin: Protok. Zasaid. Obsh. Morsk., XVII., 89. Kronstadt, 1880.

"Abscess of the Post-Auricular Region without Disease of the Middle Ear," F. C. Hotz: Archives of Otology, IX., 1880.

"Foreign Bodies in the Ear," Charles H. Burnett: American Specialist, March, 1881.

"Corpo extranto de ouvida. Morte em seguida a tentavas repetidas de extracção": O Correio medico de Lisboa, Jan. 15, 1881.

"The Nitrate of Silver Treatment of Eczema of the Ear," H. Knapp: Archives of Otology, Dec., 1880.

"A Case of Primary Superficial Mastoid Inflammation," S. M. Burnett: Archives of Otology, IX., 4.

Middle Ear.

"On the Introduction of Liquids into the Eustachian Tube and Middle Ear," S. J. Jones: Trans. Am. Medical Assoc., 1880.

"On the Functions of the Chorda Tympani," Oscar Wolf: Archives of Otology, Dec., 1880.

"Skin-Grafting in Chronic Suppuration of the Middle Ear," Edward T. Ely: Archives of Otology, Dec., 1880.

"Behandling af Otorrhœa," Thaulow: Norsk. Magaz. fur Läger, R. 3, Bd. X.

"On Disease of the Mastoid Cells," F. Buller: Canada Med. and Surg. Journal, IX., 257, 1881.

"Otorrhœa, Hints on Treatment," H. Gradle: Chicago Med. Review, II., 567, 1880.

"Ueber den therapeutischen Werth von Einspritzungen medicamentöser Flüssigkeiten durch die Eustachische Ohrtrompete," J. Gruber: Monatschr. für Ohrenheilk., XIV., 133, 1880.

"Foreign Body removed from the Middle Ear after remaining Fifteen Years," R. P. Thomas: Gaillard's Medical Journal, XXX., 521, 1880.

"Die frühzeitige Perforation des Warzenfortsatzes bei Otitis media purulenta acuta, complicirt durch acute Entzündung der Warzenzellen," F. C. Hotz: Archives of Otology, IX., 340, 1880.

"Eröffnung des Processus mastoideus," Schmaltz: Deutsch. med. Wochenschr., VI., 659, 1880.

"Common Earache, alias Acute Catarrhal Inflammation of the Middle Ear," T. F. Houston: Southern Med. Record, X., 393, 1880.

"Ein Fall von Trommelfellruptur nach einer Ohrfeige," T. J. Dills: Archives of Otology, IX., 367, 1880.

"Two Cases of Traumatic Perforation of the Membrana Tympani," F. M. Pierce: London Specialist, I., 25, 1881.

"On a New Method of Treatment of Relaxation of the Membrana Tympani," William A. McKeown: Dublin Journal of Med. Sciences, Jan., 1881.

"On the Metastases of Inflammation from the Ear to the Brain" (conclusion), J. A. Andrews: N. Y. Medical Record, March, 1881.

"Physiology of the Eustachian Tube," Fournie: Rev. mensuelle de laryngologie, d'otologie, et de rhinoscopie, Oct., 1880.

Internal Ear.

"The Cochlea of the Ornithorhynchus Platypus compared with that of Ordinary Mammals and of Birds," Urban Pritchard: Proc. Royal Soc., Lond.

"A Peculiar Modification of the Osseous Tissue in the Pyramid of the Temporal Bone," S. Moos and H. Steinbrügge: Archives of Otology, Dec., 1880.

"Necrosed Bony Labyrinth removed from the Right Ear of a Deaf-Mute Girl Nine Years Old," J. Kirk Duncanson: Edinburgh Med. Journal, Feb., 1881.

"Meningitis durch einen Ohrpolypen und Otitis interna suppurativa," Lehmann: Prakt. Arzt. Wetzlar, XXI., 219, 1880.

"Observations on Aural or Auditory Vertigo and Tinnitus Aurium, with Diagnosis and Treatment," Laurence Turnbull: Trans. Am. Medical Assoc., 1880.

"Auditory Vertigo," P. McBride: Edinburgh Med. Journal, Jan., 1881.

MISCELLANEOUS.

"On the Influence of Temperature on the Musical Pitch of Harmonian Reeds," Alex. J. Ellis: Read before the Royal Society, London, Feb. 3, 1881.

"The Photophone," Lord Rayleigh: Nature, Jan. 20, 1881.

"Action of an Intermittent Beam of Heat upon Gaseous Matter," Prof. John Tyndall: Read before the Royal Society, London, Jan. 13, 1881.

"Sur la radiophonie," M. E. Mercardier: Jour. de physique, Feb., 1881.

"The Telephone and Microphone in Auscultation," C. J. Blake: Boston Med. and Surg. Journal, Nov., 1880.

"On Diseases of the Ear in Locomotive Engineers and Firemen, which may Endanger the Travelling Public," S. Moos: Archives of Otology, Dec., 1880.

"On False Hearing and Autophony in Singers, Speakers, and Performers on Certain Musical Instruments," Samuel Sexton: N. Y. Medical Record, Jan. 22, 1881.

"Diplacusis Binauralis, Self-Observation," J. A. Spalding: Archives of Otology, Dec., 1880.

"Remarks on the Effect of Quinine on the Hearing" (H. N. Spencer and others, St. Louis Medico-Chirurgical Soc.): St. Louis Courier of Medicine, Nov., 1880.

"An Interesting Case of Protracted Deafness caused by the Report of a Musket," Gustav Brunner: Archives of Otology, Dec., 1880.

"Deafness as the Result of the Poison of Syphilis" (continued), Laurence Turnbull: Med. and Surg. Reporter, Dec. 11, 1880.

"Scarlet Fever as a Cause of Ear-Disease" (editorial): Med. Times and Gazette, Oct., 1880.

"The Importanee of a Knowledge of Diseases of the Ear to the Student and General Practitioner of Medicine," Thomas Barr: Glasgow Medical Journal, Jan., 1881.

"Case of Partial Deafness cured by an Attack of Typhoid Fever," E. F. Wells: Cin. Laneet and Clinic, Dec. 4, 1880.

"Case of Deafness, with Remarks," W. Douglas Hemming: The Specialist, London, Oct., 1880.

"Nogle Bemaerkninger om Studiet af. Dorstumhedens," J. Mygge: Ugeskr far Laeger, II., 329. Copenhagen, 1880.

"Deaf-Mute Statistics of the Provinee of Pomcrania and the Distriet of Erfurt," R. F. Wilhelmi: Archives of Otology, Dee., 1880.

"On the Use of the Dentaphone with Deaf-Mutes," Edmund Treibel: Arehives of Otology, Dec., 1880.

"A Method of Extracting the Petrous Bone for a Post-Mortem Examination of the Ear," A. Clerk: British Med. Journal, Jan. 8, 1881.

"Arrested Prodromal Insanity with Auditory Hallucinations and Automysophobia": The Alienist and Neurologist, Jan., 1881.

NOTES.

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ORIGINAL COMMUNICATIONS.

COMPARATIVE MORPHOLOGY OF THE EAR.

BY CHARLES SEDGWICK MINOT.

THE present article is the first of a proposed series, intended to present a comprehensive summary of our knowledge of the structure of the ear. A great amount of work has been devoted to this subject, and many important discoveries have been made; yet there is, I believe, no recent general review of the matter. The articles will be entirely compilations. It is my intention to ultimately revise them to form a chapter in a work on comparative histology.

The articles will all be illustrated, and will take up the different classes of animals in their proper order. The invertebrates will require but a brief treatment.

1. THE MEDUSÆ.

The lowest animals known to have auditory organs are the medusoid jelly-fishes (*Discophori*). These animals have the general shape of a concavo-convex disk, and the edge of the disk bears various tentacles, contains a circular tube known as the *ring canal*, and is also prolonged into a thin flap—the *velum*. Besides these structures, this edge bears certain small bodies of two kinds: one,

pigmented spots regarded as ocelli; the other, containing concrements (otoliths), and on that account recognized as auditory organs. In most jelly-fishes the two sensory organs are quite separate, but in the Acraspeda an ocellus and *Hörkörper* are placed together on a common stalk.

The sensory bodies are easily found; thus, in the common *Aurelia* there are sixteen notches in the edge of the disk, in each notch two little lappets, and between the bases of each pair is a projecting sensory body with both pigment and concrement-spot.

The auditory organs of Medusæ have been elaborately investigated by the brothers Hertwig,[1] and the presentation of their results is the first object of the present article. The sense-corpuscles have been long known to naturalists, and several of the earlier writers have described their varying distribution and numbers in several species. There are also fragmentary observations upon their histological structure recorded by certain authors, notably Gegenbaur, Fritz Müller, Kölliker, and Hensen. Haeckel has also published descriptions of them, but unfortunately is grossly in error on important points. The brothers Hertwig have, with rare skill and patience, investigated these organs and determined their principal homologies. They examined both living specimens, microscopic sections, and macerated tissues. To harden the tissues for cutting they were placed in 0.5 per cent. solution of osmic acid for five to fifteen minutes, then colored in diluted Beale's or picrocarmine, and preserved in weak alcohol. For cutting, they were embedded between two pieces of liver, previously hardened in alcohol and cut out to fit around the tissue. Several of their figures have been engraved for a treatise upon "Comparative Histology," and, by a special arrangement due to the liberality of the editor of this journal, are herewith reproduced. The velum, *V*, when represented, is drawn in an unnatural position, that is, turned outward, instead of reflected back under the edge of the disk and the ring canal, *R*.

The auditory organs are of two types: the first type is found in the *Vesiculata*, and is developed from the ectoderm; the second

[1] Oscar and Richard Hertwig: Das Nervensystem und die Sinnesorgane der Medusen. Monographisch dargestellt. Pp. x. and 186, Taf. I—X. Leipzig, 1878.

type is found in the *Trachymedusæ* and *Acraspeda*, and is developed from both ectoderm and entoderm. The latter type offers the only instances known of the inner germ-layer directly participating in the formation of an auditory organ. It is possible for it to form accessory parts, because it comes into immediate proximity with the ectoderm in several places where the mesoderm is absent. Thus, in Fig. 1, the ring-canal, *R*, as seen in a radial section through the edge of the disk, is formed by an epithelium (entoderm) which runs close up to the ectoderm at the base of the velum, *V*.

The otocysts of the first type present a series of modifications, the simplest form being an open cup on the under side of the velum (Fig. 1, *V*) (the velum being everted). In the higher form the cup is not only deepened, but its opening is contracted until it becomes entirely closed over. We begin our review with the first form as found in *Mitrocoma*, and probably in the American *Tiaropsis*, the auditory organ of which has been described as an eye by Louis Agassiz; and also in *Halopsis*. The two latter genera occur on our coast, and it is to be hoped that some investigator will study them. About eighty auditory cups are found in *Mitrocoma*, in the base of the velum around the edge of the disk or umbrella, there being one between every two main tentacles. A radial section through a cup (Fig. 1) shows its simple structure. The ring-canal, *R*, is cut transversely, and is lined upon its lower surface by large, ciliated, epithelial cells. The ectoderm, *Ec*, comes down from the gelatinous disk above, and consists of very much flattened epithelial cells. When it reaches the level of the ring canal it suddenly

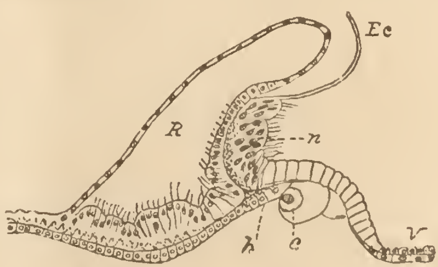

FIG. 1.—*Mitrocoma annæ.*—Radial section through edge of disk and an auditory cup: *R*, ring canal; *Ec*, ectoderm; *n*, neuro-epithelium; *V*, velum; *c*, concrement cells; *h*, hearing-cells.

becomes a thickened neuro-epithelium, which has upon its free surface (sensory?) hairs, and at its base nerve-fibres and ganglion-cells, as indicated by the dotting in the figure. The ectoderm on the under surface consists of cubical cells. Both parts of the

outer cell layer extend beyond the lower external angle of the ring canal, forming conjointly a circular flap or velum, *V*, around the edge of the disk. These relations are perhaps more clearly shown in Fig. 4, but can also be followed out in Fig. 3. In most radial sections the velum presents no especial peculiarities; but such a section through an auditory cup shows that the cup is formed by an upward arching of the velum to form a little dome, characterized not only by its shape, but also by striking differentiations of the epitheliums of the velum. The cells of the upper layer are much enlarged (see also Fig. 2, *ec*), their walls very much thickened, so that when the epithelium is viewed from the surface its appearance reminds one of a honey-comb. The contents of the cells are chiefly fluid, with a small nucleus generally in the base of the cell. These cells cease abruptly both toward the neuro-epithelium and the velum. The epithelium of the under side, which makes the lining of the cup, consists of three kinds of cells, running in bands parallel with the ring canal, and therefore cut across in Fig. 1. The outer band is unmodified epithelium, the middle band a variable number of large *concrement-cells*, *c*, the innermost auditory cells (*Hörzellen*), *h*. The concrement-cells are large, projecting above the level of the rest of the epithelium, and are distinguished by containing an irregularly spherical concretion, with a small depression at one point of its surface. The concretion is attached to the free end of the cell, where the cell-nucleus also lies; is soluble in acids without formation of bubbles, and therefore probably composed of calcic phosphate with an organic basis. There are ten to twenty of these cells of various sizes in each cup. The concretions are regarded as otoliths. The third band, nearest the ring canal, is formed by very delicate *Hörzellen*, three to five to each concrement-cell. They have each an auditory hair, while their bases taper down to fine threads.

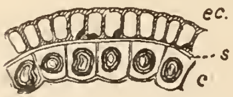

FIG. 2.—*Mitrocoma annæ*—Section through concrement-cells of auditory cup, taken at right angles to radius of disk: *ec*, upper epithelium; *s*, supporting membrane; *c*, concrement-cells.

The essential features, then, of the organ under consideration are: a cluster of *Hörzellen* of typical form, outside of which is a smaller number of concrement-cells, both kinds being developed from the ectoderm of the under side of the velum. The modifi-

cations of the organ are produced by variations in the size and shape of the whole, and in the size, shape, and number of the auditory and concrement-cells.

As before mentioned in the majority of the *Vesiculata*, the cup grows deeper and becomes a closed sack. As this otocyst is essentially the same in all the remaining species of this group studied by the brothers Hertwig, it will suffice to give the results obtained from *Aequorea forskalea*, a species estimated to have the astonishing number of six hundred otocysts. The most important points are illustrated in a radial section (Fig. 3). The ring-canal, *R*, and velum, *V*, occupy the same relative positions as before. The thickened ciliated neuro-epithelium lies just outside the ring-canal. Between the neural band and the base of the velum intervenes the otic vesicle, upon the upper wall of which are the concrement-cells, *c*, usually several irregularly distributed, sometimes only one. On the inner walls are the *Hörzellen*, quite numerous, and larger than in *Mitrocoma*. The lower side is of course not open, but closed by epithelium. The section, however, still plainly indicates how the shutting took place by the gradual approximation of the rim of the cup toward its own centre. This is especially shown by the course of the so-called supporting membrane (Stutzlamella, cf. Fig. 4, *s*), a structureless sheet which lies, on the one hand, between the ectoderm and the ring canal; on the other, between the upper and lower epithelium of the velum. In *Aequorea* the lamella passes over the *Hörzellen* and concrement-cells, and down through the outer wall of the vesicle, but does not pass round below. In other words, the growing together has not extended so far as to include the lamella. The minute structure of the parts requires a short additional description. In the first place, it is to be especially noticed that the outer epithelium of the otocyst is a simple layer, the singular honey-comb-like cells of *Mitrocoma* being

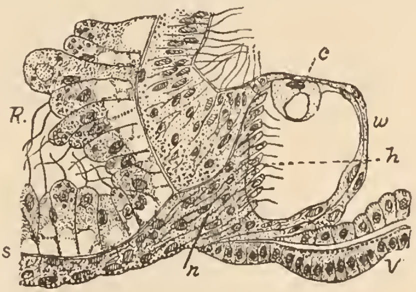

FIG. 3.—*Aequorea forskalea*.—Radial section of an otocyst: *R*, ring canal: *c*, concrement cells: *w*, wall of the vesicle; *h*, hearing-cells; *V*, velum; *n*, nerve.

absent. The concrement-cells project with rounded ends above the epithelium, contain little protoplasm, and a basally placed nucleus. The concretion is normally pear-shaped (but easily distorted by reagents), the pointed end being attached to the thick membrane over the free end of the cell. The sensory cells, *h*, are small, but may be more easily studied in the allied genera *Obelia* and *Phialidium*. Each cell has one hair, an oval nucleus, a tapering base, and a lamellar projection, running toward the base of the concrement-cell, essentially as in *Mitrocoma*. The hearing-cells have their long axis always oblique, that is, never perpendicular to the surface of the epithelium. The *Hörzellen* sit upon a mass of cells and fibres (Fig. 3, *n*), which also help to close the lower side of the vesicle. The same structure can be detected in the open cup of *Mitrocoma* under the epithelium alongside the auditory cells (Fig. 1, *h*).

We pass now to the second type of auditory apparatus, which is found in the *Trachymedusæ* and *Acraspeda*. The Ocellata have no organ of hearing. In the second type, as in the first, the essential elements are hair-cells and concrement-cells, but the latter are derived, not from the ectoderm, but from the inner germ-layer. The interesting development of the organ was followed by preparations of young *Cunina lativentris*. At a point where the auditory apparatus is to be formed, the lining of the ring canal develops an outgrowth of a few cells, which push the ectoderm out before them. This outgrowth takes place in the midst of the neural epithelium,

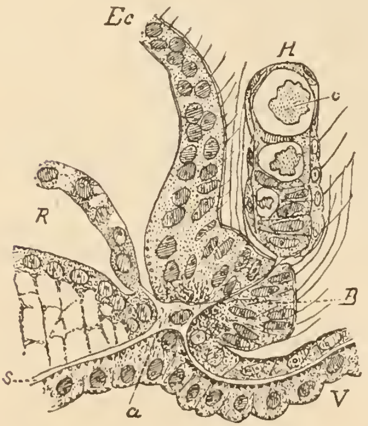

Fig. 4.—*Cunina lativentris*.—Radial section through the auditory knob: *R*, ring canal; *Ec*, ectoderm of the disk; *H*, auditory knob; *c*, concrement; *B*, auditory bolster; *V*, velum; *a*, entodermic cell derived from ring canal; *s*, supporting lamella.

just above the base of the velum. The cells from the entoderm become constricted off from their connection with the ring canal, and it soon projects like a small tentacle, which ultimately is constricted around its base (Fig. 4, *H*). The ectoderm, covering the

rod or knob, becomes a simple epithelium, as in *Cunina*, etc., or may be developed, in part, into auditory cells, as in the *Geryonidæ* (Fig. 6). The entodermic or axial cells, on the other hand, give rise to the concrements (Fig. 4, *c*).

In the simplest form, found in the Aeginidæ, the neuro-epithelium around the base of the knob, and some of the ectodermal cells upon it, become converted into the sensory cells, bearing long hairs (Fig. 4), which reach up around the sides of the knob. The concretions vary in number; in *Cunina*, there are usually two in the distal ends of the knob. The concrement-cells resemble, in a general way, those of the Vesiculata. The concretion, however, possesses a more crystalline character, which, in some species, is very marked. The axial cells are much flattened and form a single row; the nucleus occupies nearly the whole thickness of the cell. They are separated by a prolongation of the supporting membrane from the ectoderm of the knob, and this membrane extends down through the neuro-epithelium to the cell, *a*, originally a part of the wall of the ring-canal. In this manner a trace of the original connection of the axis, with the entoderm, is permanently preserved. The outer epithelium of the knob bears short hairs, which cross the long, stiff, curving hairs of the auditory bolster (*Gehörpolster*), *B*. From observations on several members of this family, it appears that nerve-fibrillæ enter the knob, and that the hair-bearing cells have tapering bases, which probably become connected with the fibrillæ; hence, it is supposed that the epithelium of the knob has auditory functions.

The essential features of this arrangement then are, that a knob with an entodermic axis grows up at a point in the neuro-epithelium and becomes constricted at its base. The terminal, or the terminal and penultimate cells of the axis, develop concrements of phosphate (?) of chalk with an organic basis. The ectoderm over the knob and around its base is converted into the sensory hair-bearing epithelium. Modifications are produced by variations in shapes and proportions of the part. Thus, in *Aeginopsis mediterranea*, the knob is pear-shaped, with a single large, spherical concrement (cf. Fig. 5); in *Cunina sol maris* the bolster is so prominent that it forms a distinct papilla.

In the family of Trachynemidæ, homologous structures are preserved, with an advance of organization in some forms. The knob is smaller, and there is no distinct bolster, although the epithelium around the base of the knob bears sensory hairs, which, however, are of the same length (in *Aglaura*) as, or shorter (in *Rhopalonema*, Fig. 5) than, the hairs upon the knob. The young of the last-mentioned genus have at first four simple knobs closely similar to those of *Aglaura;* but when older they then acquire eight, which attain a higher differentiation in that a proliferation of the ectoderm takes place, forming a circular wall around the base of the knob. The wall grows upward and gradually closes over the knob, leaving for a long time a small opening (Fig. 5), which, however, ultimately disappears. In this manner a closed otocyst is formed, strikingly similar to that of *Aequorea*, which has a different developmental history. The walls of the otocyst (Fig. 5) are composed of two epithelial layers, and hold a fluid in which the knob is suspended.

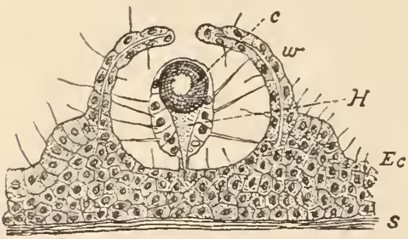

FIG. 5.—*Rhopalonema velatum.*—Horizontal optical section of otocyst, still open: *H*, knobs; *c*, concrement; *w*, wall of vesicle; *Ec*, ectoderm; supporting lamella.

In the Geryonidæ there is a further departure from the primitive form, which causes a very interesting approximation to the otocysts of molluscs and the higher animals. The organs in question are vesicles, which agree in all the essential points of their structure with the otocysts last described (of the Trachynemidæ), but their position is changed from the exposed surface to an inward place, where they are embedded in the gelatinous tissue of the disk. The knob is suspended from the side of the vesicle farthest away from the surface, just as we should expect. The walls of the vessels are lined by a single layer of epithelium, so that we are forced to conclude that the sac was formed by the sinking in of the knob. The axis of the knob consists of two cells, the distal one with a large concrement (Fig. 6, *c*). The ectoderm on one side is simple; on the other side of the knob is differentiated into large hair-cells, *h*, with stout, curving hairs. Owing to the position of

the otocyst the nerve-fibrillæ have to run some distance. They are gathered into two nerves, which pass around the walls of the vessel (Fig. 6, *n* and *n'*), to enter the base of the knob.

The *Acraspeda* have an auditory knob, quite similar to that of the Geryonidæ, but presenting certain important peculiarities, of which only three need be mentioned here: *First*, the otic organ is closely combined with the ocellus, which is placed either directly upon, or in close proximity to, the knob. This relation can be seen in our common *Aurelia*. *Second*, the knob is sunk in a little depression and covered over by two lappets. This disposition is intermediate between the free exposure of the knob and its shutting in in a vesicle entirely closed and embedded in the gelatinous tissue of the disk. *Third*, in some species the otolith is not a compact concretion, but a mass of small, crystal-like deposits (*e. g.*, *Aurelia*), which are deposited in the entodermic axis. Without further details, it is evident these organs belong to the second type we have considered.

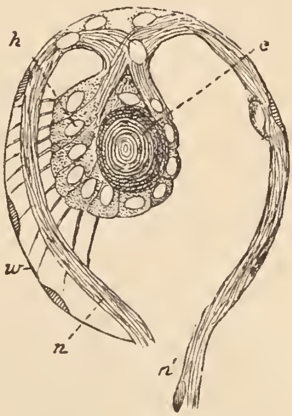

FIG. 6.—*Carmarina hastata.*—Otocyst seen from the surface: *h*, hearing-cells; *c*, concrement; *w*, wall of vesicle; *n* and *n'*, nerves.

The manner in which the knob is developed is essentially the same as for a simple tentacle, which is an ectodermal tube filled with a rod of cells from the ectoderm. We are therefore justified in regarding the auditory knobs as specialized tentacles. They are entirely distinct from the auditory organs of the Vesiculata, which are developed from the velum, as we saw above.

No experiments have yet been made to demonstrate the auditory functions of the organs we have described. Yet their structure leaves little opportunity for questioning the physiological value assigned to them. It is evident that the exposed external position offers no valid objection to the view advanced, for not only does embryology teach us that the auditory organs are developed from the exposed ectoderm, but in some animals, such as the common cray-fish, the ear is an open pit. Positive evidence is offered

by the sensory cells with their long, stiff hairs, and by the concrement-cells, with their mineral deposits, otoliths. It is true that the otoliths of most animals are free bodies in the interior of the otocyst, although they are attached to the walls of the vesicle in the Tunicates and many worms. Yet they probably always arise as a deposit in one of the cells of the epithelial lining of the otocyst, as Fol[1] has shown to be actually the case in certain molluscs. In view of these close resemblances of organization with undoubted otocysts, the concrement-organs must be regarded as unquestionably auditory in function.

In the Medusæ we find, as it were, the auditory organs in their origination. General sensory cells become in the Vesiculata hearing-cells by entering into relation with a concrement-cell. In the remaining Medusæ, excepting the Ocellata, a rudimentary tentacle becomes constricted around its base, sensory cells are developed upon or around it, and concretions (otoliths) are formed in its entodermic axis. Both types acquire a higher development by coming to lie in pits, which may afterward close over, forming shut vesicles filled with fluid.

[1] Hermann Fol: Études sur le Développement des Mollusques. Paris, 1875.

GIDDINESS AND MIDDLE-EAR DISEASE.

By H. N. SPENCER, A.M., M.D.,

ST. LOUIS.

The intimate relationship existing between certain regions and organs of the body, and the effect by a peculiar influence which disorders of one part may exercise upon another, are facts which have long been recognized, if they have not been understood. Much has been contributed in a comparatively recent period to our knowledge upon this subject, and nothing has conspired more to the advancement of practical medicine and surgery. The media of this influence between regions remotely situated relative to each other are of course in those established channels of intercommunication which regulate life and health in the organism. It is well understood that there exists a more intimate physiological relation between some regions than others, and there are constituted thus areas of community, or, what Woakes is pleased to term "correlated areas."

It is my purpose to illustrate, by means of cases from practice, some of the relationships of the labyrinth, to point out the significance of a symptom which often perplexes the medical adviser, and to show the determining influence which diseases of the middle ear exercise in the production of this phenomenon.

Any disturbance of the equilibrium can only result from a disturbance of the labyrinthine contents, whether the causes operating to produce it are intrinsic or extrinsic. It may be well at the outset to hold up in contrast, however, the marked distinction that exists between the effects produced in the operation of these widely differing causes. Any serious trouble having its origin within the labyrinth is to be recognized by the suddenness and profundity of the attack induced, its abrupt termination, its distressful consequences upon the hearing, and its want of recurrence; whereas, the

giddiness which is produced by causes operating from without bears a certain relation in time and intensity to the operating force—these forces being, for instance, pressure from products of inflammation or consequences of inflammation within the cavum tympani, or circulatory pressure, or pressure from the arachnoid cavity in the direction of the labyrinth (Weber-Liel). I think it important to make the line of distinction here between diseases of the labyrinth and aural neuroses very broad, and much of the vagueness which has hitherto attached to the subject is relieved. Where there appear to be difficulties in the way of a differential diagnosis, they vanish when a history of the case is made to throw light upon them.

I am inclined to think that the neurosis may become a habit, and may at last give rise to structural changes as vaso-motor disturbances of the function of the kidney produce kidney disease, and as the brain is found affected after puerperal eclampsia; or, to use an illustration nearer at hand, as an actual inflammation of the middle ear follows the continued reflex irritation consequent upon the process of dentition. I am inclined to think this, for I have observed that it does not require the same intensity of cause to produce the same effects, as a case progresses, which was required in the beginning, or, in other words, the proximal and the distal disturbances do not continue to bear a fixed relation to each other. From this premise it seems to me that it is not an unwarrantable deduction to state that we may have just in this influence an explanation of many cases of a high degree of deafness and distressing tinnitus which we cannot refer altogether to deflections in the conducting apparatus.

After the experiments of Flourens, Vulpian, Goltz, Boettcher, Cyon, Mach, and others, and the valuable work which has been done by Hughlings-Jackson, Ferrier, and Gowers, no one can contribute to-day a better service to otology than he who assists toward the further clearing up of the ground which these investigators have first broken.

Dr. Edward Woakes* has placed the profession under lasting

* Deafness, Giddiness, and Noises in the Head. By Edward Woakes, M.D. Second Edition. H. K. Lewis. London, 1880.

obligations to himself, whether his views in regard to the etiology of giddiness and noises in the head are entirely accepted or not.

I submit these cases, and make no claim for interest in this communication further than the value and significance which the cases themselves possess and the evidence which they may afford in support of the theory of vaso-motor innervation.

Case I.—H. W. E. consulted me in the spring of 1877. He was a highly educated gentleman, and had thought much upon a trouble which affected him with great alarm. His relations to a business requiring great mental and physical strain heightened the apprehensions excited by symptoms of such a serious nature. I give the history of his case in his own words, written September 9, 1878, at my request: "My first sickness was in the fall of 1875, Previous to that time I had had no sickness of any kind for twenty years. This attack was clearly a chill. I began using quinine in large quantities. During that winter and spring I had several attacks. Late in the spring the nature of my trouble seemed to change. I will give an illustration. After a tiresome day and a hearty supper, I sat at the piano drumming, without any feeling of discomfort, excepting a very slight headache. A feeling of dizziness caused me to lie upon a sofa, when instantly a sound of rushing water, steaming, hissing, with a pulsating movement, shot through my head. I did not lose consciousness, but could neither stand nor sit. Objects flew around me, and my head felt as if it would drop off. I procured help and managed to crawl upstairs. Nausea followed with vomiting. The sounds continued after the dizziness disappeared. But a good night's rest relieved me. I had no chill. I charged the trouble to indigestion and malaria, and took more quinine. From this time on I have never been free from sounds and steaming in my head.

In June, 1876, I went to Washington, feeling very weak. While in the hall of the War Department I had an attack similar to that just described—if anything, more severe. The day was very hot, but I had not been exposed. A physician who was called prescribed bromide of potassium. From Washington I went to the Centennial Exposition at Philadelphia. I felt very well until I reached the Art Gallery; after looking at several pictures I experienced a dizziness and blowing which compelled me to go out and sit down. A second attack satisfied me that I must return home. No nausea or other sickness. Appetite and digestion good. I recovered before reaching the house where I was stopping, rode on and walked several miles. The next day I attempted to visit the Zoölogical Garden. All was well until I stepped upon the boat. A passing boat caused the waves to rock the boat in which I was. Symptoms of sea-sickness caused me to debark at once. The same sensation as before, with

a little nausea. After my return in July to St. Louis, I had two attacks—the first one in the street, and was assisted home by a friend. It was as severe as any I had ever had, and was followed by great nausea. But the head trouble exceeded that in any other case, and lasted for days. The sounds increased, and my hearing was very defective. By advice of friends I called at your office in the spring of 1877."

Examining the ears, I found the external auditory canals filled with inspissated cerumen. Exposing the drum heads by removal of these masses, they were found to be very much sunken, the manubrii malleorum being drawn upward, backward, and inward, more markedly on the right than on the left side. The hearing-distance, after the obstructions had been removed, was: right, $\frac{8}{15}$, left, $\frac{14}{100}$. A short course of treatment and a tonic obtained for the patient very great improvement. After three weeks the hearing became: right, $\frac{20}{135}$, left, $\frac{6}{100}$. There has never been a recurrence of the giddiness, except very slight attacks at long intervals, and always associated with fits of indigestion. The tinnitus has never entirely ceased. The case has been, from time to time, under my care since—the importance of which, in all cases of chronic inflammation of the middle ear, it is my custom to urge for palpable reasons found in the progressive nature of the disease and a variable climate.

Case II.—Mrs. W., fifty-six years of age, consulted me January 3, 1881. I am indebted for this case to the courtesy of Prof. J. B. Johnson. She presented head-symptoms which were very alarming to her family, for which Dr. Johnson had wisely prescribed bromide potass., together with tonics and pepsine, associating them with an habitual irritability of the stomach. Not improving under this treatment, and taking cognizance of a considerable deafness which coexisted, he advised her to consult me. She had noticed for several years, when she had eaten anything that disagreed with her, that there would commence "a beating sensation at the pit of the stomach, which appeared to pass in waves to the head, and terminated in throbbing in the ears, especially the left." She would occasionally have, in connection with these sensations, a feeling of distress in the region of the heart. In July, 1880, after eating a radish, these symptoms were more aggravated than they had ever been, and were accompanied with giddiness. Ten weeks ago she had a very severe attack, with nausea and vomiting, after eating chicken-salad and grapes. From this time on the throbbing became constant, and she suffered from giddiness to such an extent that she was never allowed to leave the house without an attendant. The dizziness was worse in the morning on rising, with a tendency to fall over on the left side, and associated with nausea. During the day, standing still or sitting down, she could obtain no rest from a sensation of swinging to and fro, which would be intensified by every movement of the head to one side or the other, and she had constantly to guard against sudden movements,

lest, with an exaggeration of the symptoms, she should fall. Altogether, her condition was one which excited the greatest commiseration. Her hearing for the voice was very fair. The watch was heard on the right side, $\frac{60}{100}$; left, $\frac{2}{100}$. The right drum-head was slightly opaque, and there was slight retraction of the handle of the malleus. The left was very much sunken, with peripheral circumscribed opacities, and a central spot of thinning involving the lower two-thirds of the manubrium.

The constitutional treatment which had been directed by Dr. Johnson was ordered to be continued, and in conjunction with local treatment her unfavorable symptoms gradually disappeared. After four months, during which time she was under treatment or observation, she left the city for her former home in Pennsylvania, declaring that she was entirely well.

Case III.—J. T. D., aged forty-eight years, had had chronic suppurative inflammation of both middle ears from childhood. He came under my care August 6, 1878. The drum-head was entirely gone on the right side, a stump of the manubrium was left, the greater portion of it having been eroded away. On the left side there had been quite an extensive destruction of the membrane. Both cavities were in a state of profuse suppuration. I shall not go into any detailed consideration of this feature of the case. He had been a dyspeptic for years, and had observed, when suffering from the effects of this disorder, that his ears would always be worse, and the right ear worse than the left. For several months previous to his calling on me, he had been suffering from giddiness, to relieve which his physician—to use his words—had "exhausted the pharmacopœia." This symptom, when it first manifested itself, he also associated with his disturbed digestion. The attacks, however, soon became more frequent. He had experienced several of quite violent character. He referred to one which had occurred a short time before. On getting out of bed in the morning he suddenly became dizzy, and inclined to fall to the right side—the floor appeared slanting to this side at an angle of forty-five degrees, and gaining a chair he seemed to be sitting on such an inclined plane. He called for help and was assisted back to the bed, when he was taken with violent nausea and vomiting.

The suppurative trouble yielded to treatment, and with this the attacks of giddiness failed. I discharged him after five or six months. About one year ago he came again to my office and stated that his right ear was discharging, and that he was suffering again from giddiness. He had been to a night-supper with friends, had eaten imprudently, and this was the consequence. A few days sufficed to set him right again. During the past twelve months he has had several such attacks—always preceded by an attack of indigestion—and the renewed suppuration and the giddiness are concurrent symptoms. The suppuration always proceeds from a bright red spot, more or less swollen, posterior to and behind the stump of the manubrium.

These are aggravated cases belonging to a larger class, which present symptoms the slighter manifestations of which come commonly under the observation of the aural surgeon. If inquiry should be made, I think in quite a large proportion of cases of chronic inflammation of the middle ear it would be found that at some time or other, under the influence of some peripheral irritation, this phenomenon had manifested itself. I would make a carollory to this statement constitute the practical points in this paper—to this effect: in every case of giddiness the middle ear should be examined for the revelation of at least one of the disturbing elements.

The two factors in Dr. Woakes' theory are pressure from vessel-dilatation, on the one hand, and pressure from disturbance of the normal relation of the foot-plate of the stapes to the labyrinthine contents, on the other.

TREATMENT OF OTHÆMATOMA BY MEANS OF PRESSURE AND MASSAGE.

By CLARENCE J. BLAKE, M.D.,

BOSTON, MASS.

The numerous discussions upon the subject of the etiology of othæmatoma to be found both in earlier and more modern otological literature, the considerable deformity usually following this lesion and the comparative rarity of the disease, justify the report of individual cases, especially if they have been availed of to illustrate any variation from the treatment usually employed.

In the *Archiv für Ohrenheilkunde*, XVII., 2, Meyer reports three cases of othæmatoma in which pressure and massage were employed in treatment, with such good results as to lead one to watch eagerly for opportunities for testing the efficacy of these procedures in similar cases.

Two cases finally presented themselves at the aural clinic of the Massachusetts Charitable Eye and Ear Infirmary, one in January and the other in June of the present year. Both were males, of light complexion, leading active out-of-door lives, with no trace ascertainable of other physical or of mental disability, and with no antecedent or individual history of insanity or intemperance. In both cases the left auricle alone was affected.

Case I.—M., thirty-two years of age, was a healthy man, well-developed muscularly, by occupation a metal engraver, and by profession a pedestrian, having attained the distinction, such as it is, of champion short-distance walker in this country—a fact which, in consequence of the severe and frequently repeated strain upon the muscular and circulatory systems implied, may have had some bearing upon the causation of the aural lesion.

Being always liable to be called upon to engage in walking matches, it had been his custom for the past five years to keep himself in constant train-

ing, walking daily from ten to fifteen miles, and "spurting" from time to time to test his best speed. It was this habitual and severe training which perhaps accounted in part for one peculiarity noticeable on his first examination: naturally of a rather florid complexion, it was observed that on any physical exertion or under slight mental excitement, such as that incident to the examination of his ear, for instance, he flushed quickly and deeply, the blush extending over the face, head, and neck, accompanied by a perceptible increase in the fulness of the pulse.

The left auricle was deformed by a pronounced swelling, slightly fluctuating, of the same color as the remainder of the skin. obliterating the superior and posterior portion of the fossa of the helix, entirely covering the antihelix and its fossa, and extending downward to the antitragus and over the superior posterior half of the concha.

There was neither pain nor tenderness upon pressure, the posterior surfaee of the auricle was smooth and firm, and the swelling of its present magnitude had been first noticed two days previously on awakening in the morning, after an unusually heavy sleep induced by more than the usual amount of exercise taken the day previously.

A small opening was made at the lower portion of the swelling, and about two drachms or more of bloody serum and a little dark blood were withdrawn; a probe passed inward and upward swept freely throughout the extent of the cavity, which was then evaeuated as completely as possible and a sponge-dressing applied; this was done by means of sponge-pads cut to shape to correspond to the normal contour of the auricle, adjusted one upon the anterior and the other upon the posterior surface, and kept in place by an elastic flannel bandage which bound the auricle tightly down upon the head. On the following day a smaller amount of serum was removed, the probing repeated, and the pads and bandage renewed.

This dressing, with the exception of the probing, which was omitted after the second day, was repeated daily, the serous accumulation steadily diminishing, until, at the end of a week, it was evident that the treatment by pressure had done all that could be expected of it and the patient was referred to Dr. Douglass Graham of this city, for massage.

Dr. Graham saw the patient four times—on January 31st, February 4th, 7th, and 17th—and applied massage for fifteen minutes at each visit, the tissues being gently and firmly rolled between the thumb and finger with gradually increasing force until the last five minutes, when the pressure was as gradually diminished. Neither frictional rubbing nor oily applications were employed. There was no pain caused by the massage, but it was accompanied and followed by an intense hyperæmia of the auricle, which, however, subsided within an hour or two.

Under this treatment the skin became thinner and more supple, and glided over the cartilage more freely. With the thinning of the skin the cartilage

could be felt more freely, and this evidently became more uniformly smooth and firm, and the ear less sensitive to cold. When last seen, early in March, the auricle had resumed its normal appearance, with the exception of a small hard nodule four millimetres in diameter, just above the antitragus, the point at which the incision had been made; the upper portion of the auricle showed the normal contour of its elevations and depressions, and the skin was as firmly adherent as on the other ear.

Case II.—B., forty-six years of age, a teamster, awakened on the morning of the day of his appearance at the clinic, to find a painless swelling at the upper portion of the left auricle; on the evening of the previous day he had exerted himself especially in loading heavy bales of goods.

The swelling, which was neither red nor tender, obliterated the fossa of the antihelix entirely, and the fossa of the helix at its upper part for a length of two centimetres, extending upward to include a portion of the helix, but not projecting materially upon its posterior surface, and extending downward to the lower outline of the antihelix, but not encroaching upon the surface of the concha. The patient had no recollection of any blow upon the auricle during the previous day, and no cognizance of any pressure upon it during the night. He was a perfectly temperate man, well developed muscularly, and being somewhat undersized, was subject to occasional very severe exertion in the prosecution of his business.

A small opening was made in the lower portion of the swelling, and clear, serous fluid evacuated. Sponge-pads and bandages were then applied, as in the previous case. But three daily dressings were made; in connection with the last, and following it, I employed massage in the manner indicated by Dr. Graham, and on the fifth day the auricle had so nearly resumed its normal appearance that the patient was discharged, with instructions to continue the massage himself, and to put in an appearance in case of any return of the swelling.

In reviewing these cases and the success of the treatment employed, it must be considered that both patients were healthy men, with no antecedent history, so far as could be ascertained, which would indicate other than a local and accidental cause for the lesion, that both patients made early application for treatment, and were sufficiently intelligent to carry out accurately the instructions given them, which included, in both cases, in addition to the local treatment, directions for general hygiene and especially the avoidance, for the time being, of any extra exertion.

A comparison of these cases with those reported by Meyer *

* Reviewed in No. 1, Vol. III., of this journal.

emphasizes the above-mentioned advantages, which undoubtedly contributed largely to the successful results. In Meyer's first case the patient did not apply for treatment until six weeks after the first appearance of the swelling; its incision was followed by general inflammation of the auricle, to which the procedure of stuffing the cavity with charpie may have in a measure contributed; and after the subsidence of the inflammation, massage was employed as often as four times daily.

Without committing the injustice of criticising the treatment in a case known only by report, I may say that my experience of massage, as applied to the results of inflammatory affections of other parts, would incline me to use it with great caution in cases similar to those which are the subject of this paper, and to defer its use until pressure had very nearly accomplished the restoration of the normal contour of the auricle.

A NEW AND SIMPLE PROCEDURE FOR ASSISTING THE REMOVAL OF FOREIGN BODIES FROM THE EAR.

By E. D. SPEAR, Jr., M.D., [1]
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The importance of a proper employment of the simplest means for removing foreign bodies from the ear has been frequently spoken of by those familiar with this class of cases, for so many instances of serious injury to the deeper-seated portions of the ear are on record that aurists have learned to resist the temptation to immediately resort to instrumental means for extraction, and, in ordinary cases, incline to make use of the syringe alone.[1] A large proportion of these cases, requiring skill and dexterity in their treatment—which apply not only for removal of the foreign body, but for treatment of injuries consequent upon injudicious attempts at extraction—would never be seen in our aural clinics if this rule was more strictly followed by the profession at large. It is therefore with the hope of furnishing another ready and simple means of treatment that the writer offers the following method, which occurred to him some months ago. Since that time, Dr. Clarence J. Blake, to whom the suggestion was then made, has made use of it in several cases.

When a foreign body has been placed within the auditory meatus, and no attempts at its removal have been made, it will often be found in the cartilaginous portion of the canal, and impinging upon the wall, near its outer end. If the fingers are now pressed firmly upon the skin, close to and in front of the tragus, carried upward and around the meatus upon the auricle and back again to their starting-point, then lifted up, and the manœuvre repeated several times, the foreign body will be seen to move outward, and will finally drop into the depression at the bottom of the concha.

When the foreign body is lying beyond the centre of the cartilaginous portion of the canal, and has even been pressed partly into the osseous portion, the same movements of the canal will bring it nearer the entrance of the meatus, or will perhaps change its position so that other means, such as syringing, will more easily remove it.

An explanation of this result is afforded by a careful examination of the movements of the foreign body, and of the walls of the canal which surround it under this manipulation. It should be remembered that the cartilage which forms the auditory canal winds spirally inward, and has considerable elasticity; and that the lumen of the canal diminishes gradually in size from without inward, the meatus being funnel-shaped. This spiral shape of the canal permits that portion of the cartilage and skin which lies under a given point on the foreign body to slide a little beneath it, in advance of the pressing fingers, thus coming into a new position in relation to the foreign body, and, by impinging at a new point, to carry this part of the body outward as it recoils beneath the fingers. It is evident that the series of impulses thus imparted in succession to the body cause it to move toward the point of least resistance—which lies to the outside of it—determined by the funnel shape of the canal and by the position of the lower wall of the meatus, which here forms an inclined plane.

The effect of this manipulation has been well evidenced also even in cases where the foreign body—a bean, for instance—has been pushed into the canal until the greater portion of its bulk lay within the point of junction of the osseous and cartilaginous canal, its outer end, however, impinging upon the wall of the cartilaginous portion. Under these circumstances an impacted foreign body has been seen, under manipulation, to change its position and move outward, not to the extent of its entire extrusion certainly, but sufficiently to make its extraction by other means much less difficult, contact with some portion of the wall of the cartilaginous canal being a necessary factor in the successful application of this procedure.

CLINICAL CONTRIBUTIONS.

A CASE OF PROBABLE SYPHILITIC DEAFNESS IN ONE EAR.

By CHARLES H. BURNETT, M.D.,
PHILADELPHIA, PA.

On November 16, 1880, Mr. F., 28 years old, a barkeeper in Williamsport, Pa., consulted me at the suggestion of Dr. Nutt, of that city. The patient stated that about four months previous, after going to bed as usual, with perfect hearing in both ears, he got up the next morning deaf in his right ear, which "had roared like a sea-shell," and been deaf ever since. He is a large, fine-looking man, with light hair, fair, rosy complexion, and apparently in perfect health. He emphatically denies ever having had syphilis, though he admits having had gonorrhœa some years ago. He further denies having ever had any cutaneous eruptions or sore eyes. He has been married five years to a healthy woman, but she has never borne children. He says that, six months before his sudden deafness, he was struck by a man's fist, over the right mastoid portion, but that this blow produced no pain nor any aural symptoms; in fact, he had forgotten the occurrence until questioning recalled it. His physician writes me that the patient had admitted to him that he had had syphilis some years previous, and on this account Dr. Nutt gave him iodide of potash and bichloride of mercury, which he was still taking when he consulted the writer. But the hearing had not improved under its use.

Further examination of this case showed that the tuning-fork, vibrating on the vertex, was said to be heard equally well in both ears; that the voice was heard normally in the left ear, but only in close proximity to the right ear, if at all on that side. The Eustachian catheter, however, revealed on the right side a perfectly and easily inflatable Eustachian tube. An examination of the

mouth and fauces revealed no abnormal condition, excepting *two suspicious red warts on the velum to the left of the uvula.* The examination of the right ear revealed a very red fundus of the auditory canal and a deeply congested flaccid membrane and manubrium. While this congestion may have been due to the presence of a firmly wedged plug of cotton which the patient had long worn in the affected ear, it should be borne in mind that both Bumstead and Sexton[1] have noted such congestion as a symptom in syphilitic ear disease.

In addition, the history of syphilis, with the presence of specific warts on the velum, and the sterility of the patient and his wife, together with the sudden, profound and permanent deafness, without any very definite reasons purely aural, would tend to place this case among those of syphilitic deafness. The two great questions in such a case are: Where is the lesion? and, What is its form?

As the Eustachian tube was perfectly and very easily inflatable by the catheter, and showed no signs of having ever been morbidly closed, we are forced to look elsewhere for the cause of deafness. As the tuning-fork on the vertex was heard in the affected ear, we cannot place the lesion in the labyrinth, but we are forced to locate it in the middle ear.

In endeavoring to determine its nature, we must recall the tendency to the formation, in this man, of papilloma or granuloma as shown by the peculiar warts on the velum. In fact, in this case one is strongly reminded of the explanation of similar affections given by Dr. Sexton in the paper quoted, "that it may be surmised that granuloma, or circumscribed, small, round-cell infiltration takes place within the tympanum, that the invasion is rapid, and that it prevents by fixation the conductive apparatus from its normal movements."

This case seems so well marked in its peculiar features as to warrant its being placed among the syphilitic diseases of the middle ear, a class which Dr. Albert H. Buck proposes to place as class first, in his category of specific cases.[2]

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[1] See paper by Dr. Sexton: this journal, Vol. II., p. 301.

[2] This journal, Vol. I., p. 29.

THREE CASES OF MASTOID DISEASE IN CHILDREN.

By HENRY S. SCHELL, M.D.,
PHILADELPHIA, PA.

The treatment of mastoid disease is now so well settled that but little new light can be thrown upon the subject by the following cases. The first two are related as confirmatory simply of the correctness of accepted methods, the last to resuscitate a valuable procedure which at present languishes from neglect.

Case I.—Lizzie McGovern, eight years of age, a patient in the ophthalmic and aural department of the Children's Hospital, in March, 1880. Had suffered for one month with a discharge from the right ear. At time of admission complained of great pain and tenderness on pressure, which had existed for a week, over the mastoid process. The soft parts were thickened and acutely inflamed, and there was a perforation of the membrana tympani, with mucopurulent discharge into the external meatus, which was nearly closed by the swelling. Free leeching relieved the pain temporarily, but it returned with renewed force during the night. The usual incision was made the next day, under ether, and the periosteum found red, thickened, and easily detached. The bone was friable, and broke down readily under the point of a grooved director. An opening was thus made into the mastoid cells, from which pus flowed freely. A detergent wash of boracic acid, ten grains to the fluid ounce of water, was used several times daily in the after-treatment. The child was discharged cured in three weeks.

Case II. was seen in private practice, November 4, 1880. Jane F., five years of age. Had suffered from purulent aural catarrh in right ear for a year. The mastoid region had been sore and painful for a week. Leeching and fomentations gave relief for twenty-four hours, but the pain returned with renewed intensity. An incision was made, the bone found softened, and was perforated with a grooved director, as in the previous case. Not more than half a teaspoonful of pus was removed at the time of the operation, but the discharge continued both from the meatus and the wound for several weeks. Complete recovery in a little more than a month.

Case III.—Maggie Crease, two and one-half years of age, a patient in the Children's Hospital, December, 1880. Admitted for marasmus. A pale, deli-

cate, badly nourished child, affected with diarrhœa. Shortly after its admission, Dr. Murray Cheston asked me to examine its left ear. I found a slight discharge, perforation of the membrana tympani, and a sinus over the mastoid process, through which dead bone could be felt with the probe, and made a vertical incision, nearly an inch in length, through the sinus down to the bone, which was found to be necrosed and friable, but there was no loose sequestrum. Communication was established with the cavities of the bone, and the dead parts touched thoroughly every day with dilute sulphuric acid. The solution consisted of equal parts of the acid and water, and the application was made by means of a dossil of absorbent cotton twisted around the end of a probe. The cavity was afterward packed with lint spread with cerate. Every day the lint was removed, the cavity washed out with warm water and permanganate of potash, any loose pieces of bone removed, a fresh application of sulphuric acid made, and the wound packed as before. The discharge from the ear ceased permanently in a few days. The dead bone came away in fragments of variable size. Nearly the entire mastoid portion was gradually removed in this way, leaving a cavity at last sufficiently large to receive the end of the index finger. The treatment was continued as long as any points of dead bone could be discovered, and until the entire cavity became lined with healthy granulations. The acid was then discontinued, and the wound allowed to fill up from the bottom. The parts were entirely healed in from two to three months from the beginning of treatment.

SUDDEN AND COMPLETE LOSS OF HEARING IN ONE EAR DURING AN ATTACK OF MUMPS.

By ALBERT H. BUCK, M.D.,

NEW YORK CITY.

(Read before the American Otological Society.)

Case I.—The patient, a rather delicate girl, sixteen years of age, was taken ill with the mumps on or about March 9, 1881. She contracted the disease from her sister, but experienced it in a somewhat more severe form than did the latter. Both sides of the face were much swollen, the motions of the jaw were painful, and there was decided soreness of the throat, with a corresponding difficulty in swallowing food. On the third day she experienced a sharp pain in the right ear. It lasted only a few hours, and was associated with an unpleasant singing or ringing noise. It was not, however, until the following day that she discovered that she had lost the power of hearing in the right ear. From that time onward, the unpleasant singing noise had continued unchanged. When I was called to see the patient, on the seventh or eighth day of the attack, I found her face still decidedly swollen on both sides. Her general appearance was that of a person who had passed through a somewhat severe illness. Part of this, however, was probably to be attributed to a recent malarial attack. The hearing power of the left ear was normal, both for the ticking of the watch and for spoken words; that of the right ear had apparently been completely destroyed. When she closed the left ear firmly, she was unable to distinguish words spoken in an ordinary tone of voice at a distance of five or six feet from the affected ear. When the same words were spoken in a rather loud tone, she was able, by paying close attention, to make them out correctly. When I pressed my watch lightly against her right ear, she was unable to hear the sound of the ticking, but when I pressed the watch more firmly, she said that she could distinguish it faintly, *but with the left ear*. I tapped gently upon a silver spoon, which the patient held suspended lightly between her teeth, and she referred the sounds thus produced to the left ear.[1] The ticking of a watch, held in a similar manner between the teeth, was also referred by the patient to the left ear. Firm closure of the right ear did not alter the results obtained in these last two experiments; the ticking of the watch, and the sound of the vibrating spoon were still referred to the left ear.

[1] On a subsequent occasion I employed the tuning-fork in the usual manner, and obtained the same results.

On examination with the speculum and reflected light, I found the membrana tympani of the affected (right) ear very nearly normal in appearance. There was not the slightest evidence of congestion of the dermoid blood-vessels; the membrane proper was perfectly smooth and transparent, and there were no indications of an exudation in the tympanic cavity, or of a swollen or congested condition of the tympanic mucous membrane. The only abnormal condition that I could discover, was a slight drawing inward of the membrane beyond its natural position. The pharyngeal mucous membrane, however, presented decided evidence of having been recently inflamed. It was still markedly swollen (œdematous), and there was abundant secretion in the naso-pharyngeal space. It was only with difficulty that air could be forced through the right Eustachian tube into the middle ear. There was no paralysis of the facial nerve.

I questioned the patient closely a second time, with regard to the symptoms which immediately followed the attack of pain in the right ear, but failed to elicit any further facts of importance. She had experienced no dizziness, no nausea, no difficulty in maintaining her balance in walking or standing—in a word, none of the symptoms which are usually associated with the so-called Ménière's disease.

Although the condition of the Eustachian tube and middle ear seemed no longer to have any connection with the deafness, I directed my efforts toward restoring the naso-pharyngeal and tubal mucous membrane to a healthy condition, by means of applications of nitrate of silver, in solution, to the naso-pharynx, and of inflations according to Politzer's method.

On the first of April, fourteen days after I first saw the patient, I abandoned this plan of treatment. The naso-pharyngeal mucous membrane had, by that time, apparently returned to a healthy condition, and the air during inflation passed readily into the right middle ear. There could, therefore, no longer be any reasonable doubt that further benefit was not to be expected from treatment directed to the middle ear and neighboring mucous membranes. In its stead, I prescribed iodide of potassium, in increasing doses, and counter-irritation behind the right ear, by means of tincture of iodine. The patient began with fifteen grains of the iodide daily, and increased slowly to forty grains. During the third week, while she was taking these comparatively large doses, she began to experience the specific effects of iodine. As there was no evidence that the hearing power of the right ear was being restored, in even the slightest degree, I no longer hesitated in giving an absolutely unfavorable prognosis, and advised the patient to stop all treatment. I examined the affected ear again during the second week of May, just before the patient left for a pleasure trip in Europe, and found that the hearing still remained a perfect blank.

Remarks.—Toynbee, in his "Treatise on Diseases of the Ear,"[1] refers very briefly to the development of deafness in the course of mumps. His words are as follows: "The peculiar poison which causes the disease generally known by the name of mumps, is very often the source of complete deafness, which, however, usually occurs in one ear only. In these cases, the nervous apparatus is evidently affected, as the deafness comes on suddenly, is usually complete, and, as a general rule, no appearance of disease can be detected in the meatus, membrana tympani, or tympanic cavity. When the nerve is not wholly paralyzed, and some, although it may be a very slight degree of hearing remains, the only plan of treatment which can be recommended is the use of gentle counter-irritation over and around the ears, at the same time that the ear is exercised by means of the elastic speaking-tube." From this statement, it appears that cases similar to the one which I have just narrated were by no means rare in Toynbee's experience. Vogel, also, in speaking of those cases of mumps which terminate in suppuration,[2] says: "Not at all unfrequently, the labyrinth and middle ear participate, in which case the pus probably passes directly along the vessels and nerves that go from the parotid gland to the ear. The ossicles of the ear thus become destroyed, and, at the best, life-long deafness ensues." A short distance farther on, he says: "Apart from this, the facial nerve seems especially adapted to conduct the inflammation into the auditory apparatus." From this, it would be fair to infer that the complication under consideration is not altogether rare in Germany. And yet, in the fourth edition of Von Troeltsch's treatise, and in that great storehouse of otological facts, the *Archiv für Ohrenheilkunde*, I am unable to find a single reference to the subject. Even Schwartze, whose experience must have been very extensive, speaks of the complication in terms which would lead one to infer that he had not seen an instance of it. The passage to which I have reference is the following:[3] "Hemorrhages into the labyrinthine cavity and the mem-

[1] P. 361. London, 1860.

[2] Ziemssen's Cyclopædia of the Practice of Medicine. Vol. VI., p. 838. (American edition.)

[3] Schwartze: Pathological Anatomy of the Ear; translated by J. Orne Green, M.D., p. 157. Boston, 1878.

branous labyrinth occur with fractures of the petrous bone, with severe contusions of the skull without fracture, with atheroma of the arteries, with heart and kidney affections, with acute tuberculosis, typhus, scarlet fever, measles, and, according to Toynbee, with mumps and arthritis."

In Valleix's *Guide du Médecin Praticien* and in the classical treatise of Barthez and Rilliet no mention whatever is made of this complication. In the recent work of Pinet,[1] I find very unsatisfactory references to the subject. In fact it does not clearly appear whether the authors quoted have met with instances of the accidents which they describe, or whether they merely narrate facts which have come to their knowledge in other ways. In the works of Triquet, Bonnafont, Gellé, and Levi, no mention appears to be made of the subject. The same remark applies to the otological literature of the United States; Roosa and Burnett being the only writers, so far as I can learn, who enumerate mumps among the diseases which sometimes lead to structural changes in the labyrinth. The evidence is, therefore, quite strong, that the complete loss of the power of hearing in one or both ears during an attack of mumps, is an event of rare occurrence.

In the case which I have described, there are one or two points of interest, to which I may be permitted to call attention. In the first place, it is a striking fact that, four days after the sudden attack of pain and deafness, the middle ear of the affected side should have presented absolutely no signs of inflammation. From this circumstance alone we should scarcely be justified in assuming that, at the time of the attack, the middle ear was not inflamed. At the same time it is clear that whatever inflammatory changes took place at that time in the tympanic cavity, must have been of a very slight and superficial nature, or some trace of them would still have been visible after the lapse of four days.

As another peculiar feature of this case, I may mention the

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[1] Pinet: De l'état de nos connaissances sur l'affection ourlienne ou oreillons, p. 67. Paris, 1878. "Chez quelques malades, dit Ressignier, la fluxion catarrhale des parotides . . . . envahit le conduit auditif et l'oreille moyenne, et a donné lieu à des otites dont les accidents ont été des otorrhées légères et la perte momentanée de l'ouïe. Et encore, d'après Bergeron, on peut voir après les oreillons persister une surdité définitive, s'il y a eu de l'otite."

sudden or rapid development of complete deafness without any of those symptoms (nausea, dizziness, etc.), which are commonly interpreted in cases of this kind as indicating a lesion of the semicircular canals. If these symptoms really possess the significance attributed to them, we may assume that in the present case the lesion was confined to the cochlear portion of the labyrinth, and probably consisted in an extravasation of blood. If we admit the correctness of Vogel's view, that the facial nerve is especially adapted to convey the inflammation from the parotid gland to the auditory apparatus, it is easy to understand why the middle ear should escape, and why only the cochlear portion of the labyrinth should be the seat of serious lesions. The facial canal, after curving up over the oval window, makes a sharp turn and passes almost directly through the petrous bone to the meatus auditorius internus. On its way it passes in very close proximity to the first cochlear whorl. I have in my possession several bony preparations, or dissections, which show this relation of the cochlear to the facial canal, and in one of them the thin dividing septum of bone is lacking. It is probable that this thin lamina of bone was broken down by the chisel, but still it is possible that the defect is a natural one, like that which is occasionally observed in the bony roof of the tympanic cavity. The works on anatomy say nothing about the vascular relations between these two canals, and I am, therefore, unable to strengthen Vogel's hypothesis by pointing to the existence of such an important connection between the two regions. If, however, the inflammation in the parotid region really does travel along the facial nerve to the auditory apparatus, it is very probable that the spot to which I have referred is the one at which the disease passes from the facial canal to that of the cochlea.

Finally, I might call attention to the fact that the patient heard the ticking of the watch in the left ear when it was pressed firmly against the right or affected ear. I do not remember ever to have observed this phenomenon, although I have several times employed the watch in testing the hearing of individuals who were completely deaf in one ear. The youth of the patient, as affecting the condition of the cranial bones, and the acuteness of the hearing of the left ear, both co-operated to render such a thing possible.

Case II.—The patient, a man forty-one years of age and in good health, contracted the mumps on or about the first day of June, 1881. The swelling was noticeably greater on the left than on the right side of the face. The motions of the jaw were decidedly painful. On the third or fourth day of the attack, he discovered that he was unable to hear with his left ear. He also suffered at the same time with a loud roaring sound in the head. In the course of three or four days this noise, which had hitherto been general throughout the head, gradually became localized in the left ear. On or about the fifteenth day the patient experienced nausea and dizziness, and found considerable difficulty in maintaining his balance. These new symptoms grew more marked during the following forty-eight hours, and then began slowly to diminish in intensity. No very marked change for the better took place, however, until after four leeches had been applied behind and in front of the affected ear. This was done on the 20th or 21st of June, by the advice of the physician whom he first consulted. The roaring and the deafness remained unaffected by the local depletion, but the nausea, dizziness, and difficulty in maintaining the equilibrium were at once greatly diminished by this therapeutic procedure. In addition to this local measure an antisyphilitic course of treatment (mercurial inunctions and iodide of potassium internally) was prescribed, probably because the patient had given a history, although not a clear one, of syphilis. On or about the 9th of July the patient's gums began to be affected, and the treatment just described was abandoned. During the interval from the 20th of June to the 15th of July, the day on which I first saw the patient, leeches had been applied on two different occasions, each time with some benefit.

On examination with the speculum and reflected light, I was unable to find anything in the condition of the external auditory canal or drum-membrane that could account for the deafness or other symptoms. So far as could be ascertained by means of the usual tests, the hearing power of the left ear had been completely destroyed. The sound of the vibrating tuning-fork, when placed against the patient's teeth, was heard by him only in the right ear.

As the physician first consulted had done everything that could be done for the patient, I simply advised a repetition, from time to time, of the local bloodletting, and the employment of counter-irritation, with tincture of iodine and cantharidal collodion.

Remarks.—The case just narrated, which came under my observation after I had written the first part of this paper, suggests one or two additional points for consideration. It will be noticed, for example, that in both cases the hearing was lost on the third or fourth day of the attack: in the first with decided pain, in the second without a trace of pain, but in both with distressing subjective noises.

In the first case both parotid regions were affected, apparently, with equal severity, and yet only one ear, the right, became involved in the disease. In the second case the left parotid region was more severely affected than the right, and it was also the left ear that became involved in the disease.

Finally, in this same case a second apoplexy or inflammatory exudation seems to have taken place in the labyrinth about fifteen days later than the primary attack. While in the first attack it is fair to assume that the cochlea alone was involved, in the second it may, with equal propriety, be taken for granted that an escape of blood or a plastic exudation took place in the vestibule or in the ampullæ of the semicircular canals.

The two cases which I have reported above, and a third, of which I possess only a very imperfect history, are the only ones of the kind that I have seen.

BOOK NOTICES.

De l'Oreille et de la Surdité. Par le Dr. Gellé. Small, 8vo, pp. 320. Paris, 1881.

This very charming volume is composed of fifteen chapters, on various otological subjects, mostly physiological, and is denominated by its author "A Series of Studies in Otology." Every one of these is full of interest to the aurist, and hence, well worth reading. The book is not intended for beginners, for it presupposes a high grade of otological knowledge on the reader's part. In short, such a book is an honor not only to its author, but to the profession at large, and the specialty to which it is directed. The first chapter treats of ear disease and deafness as causes of exemption from military duty in France. The second is composed of clinical cases illustrative of various important features of aural disease, and contains some valuable details of epileptiform affections arising from aural maladies. A chapter is then given to the hygiene of the hearing, in which the effects of heat and cold are considered. It is here stated that an increase of temperature in the ear has been noted as synchronous with tinnitus aurium. Wearing cotton as a protector is condemned, while protection about the auricle, the neck, and scalp is enjoined when exposed to cold and great dampness. The latter has an especially bad effect upon the ear, as well as on all other organs, in the growing human being, as seen in the high valleys of the Alps, where cretinism, goitre, and deaf-dumbness are rife. Heat is said to lead to congestion and hemorrhage of the ear.

The author believes with J. Franck and others, that great losses of blood, anæmia, cachexia, and hemorrhoids, have a very disastrous effect on the hearing. The early establishment of the respiratory function in the new-born child is highly necessary for the welfare of the middle ear, so much so that an infant just born should be encouraged to cry as loudly as possible, in order to insure the opening of the Eustachian tube and middle ear, which is rendered perfectly patulous usually in a fraction of an hour after birth. "The middle ear is a large, osseous cell separating the temple from the petrous bone; and it comes under the influence of the tardy evolution of this bone. Hence, in the early months of life, there is at this point a remarkable activity in ossification. The petrous bone is spongy and excessively vascular at birth, engorged with venous blood, and cartilaginous at some points; then rapidly, by

an intensified nutrition comparable in its activity and results to a condensing ostitis (*ostéite condensante*), this spongy tissue forms the most compact bone in the body, the so-called petrous bone. The physician should not ignore the existence of this rapid, general and complete evolution; for it is so nearly akin to inflammation as to explain only too easily the frequency and the precocity of aural lesions and their gravity. At this age all lesions are bilateral, every otitis is a destruction of the middle ear; at this age, each otitis is an ostitis, every otorrhœa a melting-down of bone, and hence, every child becoming deaf at this age is a deaf-mute."

Congenital deafness is far less common than deafness arising after birth, no matter from what cause. Among one hundred mutes, this author states that seventy-nine, at least, became deaf after birth, as shown by Ladreyt and Lacassaque.

Of all habits, the use of alcohol and tobacco is the most injurious to hearing, and in this connection a pharyngitis of smokers and drunkards is spoken of. The action of these two habits is to produce a superficial or even a deep inflammation of the mucous membrane of the throat, nares, and the tympana. Generally, however, the sensibility of the drunkard is so blunted that he does not perceive the gradual loss of hearing, until it amounts to a high degree of deafness.

The author regards the ear as specially connected with the nerve-centres and very liable to sympathetic affection in neuropathic disturbances anywhere in the system. He believes the sense of hearing can and should be cultivated, and recommends that reading aloud by pupils, after a judicious master, is a simple method of directing their faculties toward harmonious actions. Thus, beautiful verses well recited, or choice prose well declaimed, will be better heard, better listened to and remembered, and furthermore will have a salutary effect upon the thoughts, than the same matter if read in silence.

The next chapter is devoted to a study of the movements of the membrana tympani by the graphic method. The apparatus he has employed is one of Marey's, modified by Gellé. During the experiments both ears are connected by a common tube of rubber, joined in the middle by a second, through which the impressions, which are really the sum of the actions of both tympanic membranes, are conveyed to the register. This, as the author says, would not be applicable in cases where the pathological state of one drum is to be obtained. But the author's experiments are carried out from a physiological starting-point. During these the subject must abstain from movements of the muscles of the jaw or auricle; as these would make peculiar motions, and hence be recorded on the dial with marring effect. The best results are obtained by giving the subject some water to swallow at command. In one whose ears are normal and the Eustachian tubes permeable, each act of deglutition is inscribed on the register, by a tracing which is definite, easily recog-

nized. and typical. At each act of swallowing the subject should simply lift his hand, which is specially important in pathological cases, as in such no tracing is evident on the register from the act of swallowing. This negative result, of course, is of diagnostic value.

The ordinary statement is that at each act of deglutition the tubes are opened and air enters the ears. Closer investigation shows that the circulation of air toward or in the drums can be divided into two periods. The first is when the tension and elevation of the palate closes the entrance to the nasal fossæ in concert with the contraction of the pharyngeal muscles; under this influence the walls of the tubes separate from each other and the passage is open. At the same moment there ensues a slight aspiration of air from the tympana, and consequently a suction upon the membrane, the only movable wall of the drum-cavity, and the membrane becomes more concave, *i.e.*, more indrawn. This statement is substantiated by the monometric results; for the liquid column falls in this first period of swallowing. If at the time of this act the nose is held, the aspiration becomes exaggerated, and consequently the sinking inward of the drum-head more pronounced. At this time the slight depression in the tracing is made, 10 mm. long, which begins the graph of deglutition.

In the second period of this act the passages are open and air enters; at the same time the partition, *i.e.*, the membrana, reacts and returns briskly to its normal position. This second period is indicated on the tracing by a characteristic *crochet*, which returns to the base-line promptly and re-establishes the normal position. While the first period is not sharp, but slow, the second is sharp, rapid, and sudden.

There are then considered, modification of the tracing of deglutition and its semiological value, and the "Bruit de Leudet," an objective snapping noise heard in some rare cases, and the tracing it gives.

The modification of the tracing of deglutition and semiological value are then considered and the negative results, so far as movements of the membrana tympani are concerned, obtained in cases of objective snapping noises in the ear ("Bruit de Leudet"). As in these rare cases no evidence of motion in the drum-head is obtained by the tracing apparatus, Gellé agrees with other observers that the noise is caused by muscular movements in the velum palati and tubal muscles. The amplified tracing of deglutition is then considered, and also that obtainable during Valsalva's inflation; the latter tracing is then compared with that obtained by deglutition, by close alternations of the two acts.

An inspection of the chart given in the book, shows that the *crochet* of Valsalva's inflation is much more abrupt and extensive than that furnished by the act of deglutition.

Then the auscultation of the ear and the graphic tracing of the Valsalvan inflation, and the effects of repeated and successive inflations of the latter

method, are considered. The author speaks at great length of "transauricular auscultation," as performed by himself. He has long ago abandoned, in his study of the transmission of sound through the ears, the three-limbed auscultation-tube of Politzer, and has substitued the ordinary auscultation-tube of the aurist. The author's method of auscultation is to place a watch or tuning-fork on the side of the head he is about to auscult. If now one end of an auscultation-tube is placed in the meatus of a healthy ear and the other end in the examiner's ear, while a tuning-fork is vibrating on the forehead toward the side to be examined, the sound of the fork is easily and plainly heard by the auscultator. If, however, while the sound is still heard through the auscultation-tube, the patient is told to make the Valsalvan inflation, and the membrana tympani is thus pushed outward and the tension thus augmented, the sound diminishes, and this effect is perceived by both the subject and the examiner. This is entirely due to the increased tension, for, as soon as this is lessened by the act of deglutition on the part of the subject, the sound of the fork is once more heard coming over the auscultation-tube as before. But, if the subject is now told to make an unusually energetic effort at Valsalvan inflation, both tubes being equally permeable, at the same moment that the tracing shows an abnormally prolonged and characteristic mark for the ear connected with the tracing apparatus, and the ear undergoing auscultation is heard to make the peculiar cracking produced by the Valsalvan inflation, there will also be perceived an augmentation of the sound of the tuning-fork.

This the author calls the second period of transauricular auscultation. It is this which gives it all its semiological importance, for the ear momentarily metamorphosed permits sound to pass which it was unable to conduct during the first period of the effort. The question naturally arises: What is this sudden modification, by which the organ regains its enfeebled or lost functions? The answer is gained by a reference to the graphic register: the tympanic membrane is instantaneously stretched by the further injected air, and thus the acoustic phenomena regain the physical conditions necessary for their production and propagation. These, indeed, are the same as the conditions of audition, for the same procedure restores hearing to the deaf patient.

A very interesting condition of the ear is then considered, viz., the tracing obtained in cases of rigidity of the malleus, with mobility of the membrana tympani, and then the effects of tenotomy of the tensor tympani upon the aforesaid rigidity of the malleus, and the subsequent changes in the tracing.

Sometimes the membrani tympani alone yields to the eccentric pressure of the air douche, and this usually at its posterior or "mastoid" portion behind the malleus. The displacement of the malleus in these cases is prevented by the tendon of the tensor muscle and the rest of the chain of bonelets. In a more advanced form of the lesion, both parts of the membrane appear puffed out on each side of the manubrium, while the latter lies in a deep groove between them. An act of swallowing, with the nose held, will draw these pro-

tuberances of the drum-membrane back again, and in fact so far inward as to now present the manubrium as a ridge between two depressions. This recoil is accompanied by a tracing of significant amplitude. This has a physiological as well as physical interest: but we are not prepared to admit the very great diagnostic worth claimed by M. Gellé for it. Every aurist knows that a flaccid cicatrix will bulge and recoil, without improvement to hearing so long as the malleus is immovable from any cause. And this he knows and can continue to find out without the paraphernalia of the tracing apparatus. If an artificial opening in the membrana tympani does not restore the hearing, an exploratory effort is advised in order to find out whether the malleus can be moved by a small hook, after the suggestion of Toynbee, rather than to proceed at once to tenotomy of the tensor tympani.

The author concludes that the normal membrana tympani may be displaced [illegible] of a millimetre without transcending physiological bounds. He further concludes, with Helmholtz and others, whom he does not mention, however, that the excursion of the stapes is equivalent to that of the drum-head, viz., [illegible] millimetre. He also has never been able to detect any tracing by his method, which would indicate that respiration produces the least movement in the membrana tympani. There are then considered the tracings obtainable by Politzer's inflation and the forcing air-pump, with or without catheterism, and the tracing obtained in perforations of the drum. The pulsations of the drum isochronous with those of the pulse in some affections of the ear are then considered. The general conclusions drawn from all the aforesaid experiments are:

1. It is possible to register the motions of the membrana tympani with the graphic method.

2. The study of the physiology of the membrana tympani is, as it were, renewed by the use of the graphic method.

3. The practical application gives the best results. The clinician finds in these various tracings of the movements of the drum-membrane, in patients afflicted with aural diseases, an excellent guide in judging of symptoms already known and in the analysis of the lesions observed.

4. The clearness and precision of the data obtained by the graphic method will throw light on most of the questions relative to the function and pathology of the ear.

In the next chapter Dr. Gellé considers the morphological changes which occur in the middle ear, and the functional peculiarities as seen in all vertebrates. He considers the middle ear merely a reservoir of air, and not a resonant cavity—*not a drum.* Nature, in fact, tries to isolate the perceptive part of the ear as much as possible from shocks, for it permits the access of sound-waves at only one point, viz.: the small oval window interposing between the labyrinth and the surrounding atmosphere, a large cavity filled with air, and an apparatus endowed with a power of transmitting sound, of its attenuation and its evacuation after sensation has occurred.

Instead of finding in the tympanic cavity an apparatus for the re-enforcement of sound, it is more rational to liken it to or compare it with the dark chamber of the eye. For, in man at least, its irregular walls, broken up into large cells, seem better adapted to quell than to reflect sound.

The bulla ossea of the carnivores and pachyderms does appear to be for the purpose of augmentation of sound. for in them the ear seems to be intended simply to hear sound with, aud not for purposes of comparison or analysis. But the delicacy of sensations in man demands other organic arrangements, and the bulla ossea disappears, though the tympanic cavity as a reservoir of air still remains. Monkeys have no bulla ossea; large aërial cavities, however, prolong the tympanic chamber in front, and thus constitute the indispensable aërial reservoir. In the anthropoid apes and in man the position of this air-cavity is changed, and there are found, at the posterior part of the tympanum, the mastoid cells. By a series of transformations, then, the middle ear changes from that found in monkeys, and acquires the final type as in man, when the conditions are altogether unfavorable for resonance.

These changes are not confined, however, to the middle ear, for it is impossible, according to Gellé, to confound any part of the ear of an adult man with that of its anologue in an animal. It cau be seen at once on comparison that those animals best endowed with a tympanic cavity are those most highly endowed with a remarkable fineness of hearing, as the carnivores and their prey, the rodents. The first trace of an auditory organ is found in the form of a vesicle and its nerve—in other words, the utricle finally situated in the vestibule.

At a higher point in the zoölogical scale there are added to this vesicle the semicircular cauals, and these are found in every animal from a fish to man. The function of the nerves connected with these canals appears to be entirely independent of a middle ear; at least, this develops much later in the animal series, and exclusively in aërial auimals. It is, hence, fair to conclude that the ampullar nerves and the peculiar canals so constant in form and direction in all animals, are entirely disconnected with the apparatus for transmission, conduction, and accommodation. It should be remembered here that in birds, in which these canals are very finely developed, the cochlea is almost rudimentary, and the chain of auditory bones is likewise small and atrophied. It is concluded, therefore, that the function of these canals is connected with a primordial physiological necessity, viz., with motion manifested by direction, station, and equilibration.

All animals possess the power of knowing the direction of sound, and this function, the author concludes, lies in the semicircular canals. They are certainly added in the scale of development in order to increase the powers and services of the ear, for those animals endowed with semicircular canals are superior organisms to those possessing simply an utricle as their only acoustic organ. The latter variety can go either toward or flee from noises at will.

But they do not possess powers of analysis of sound. Gradually, however, in the vertebrates the cochlea is developed, and the tympanum with its contents, as in man, and not until then does it appear that the power of analysis of sound is gained. For this purpose the cochlea and the tympanum are requisite.

Man's auditory organ is peculiar to him. As his hand differs from the paw of a monkey, so is his ear the distinctive seal of humanity.

In general the malleus is shorter in man than in the other animals. The monkey's is nearer that of man, and the length of the malleus in rodents and and carnivores is still greater. The conditions are reversed in the development of the incus. The fifth chapter after this one is cognate to it, as it treats of the ear viewed simply as an anthropological study. Its value in this respect is based on a consideration of the mastoid apophysis as an indication of man's biped and erect station.

The four intervening chapters are upon the experimental study of the phenomenon of the outward escape by the external auditory canal of sound-waves coming from the skull—metallo-therapy in hysterical deafness, and the transference of the symptoms from the diseased side to the unaffected one, which phenomenon the author claims to have produced. Then the circulation of air in the tympanum, a chapter apropos of Dr. Löwenberg's paper on the introduction of irrespirable gas into this cavity, and a chapter is also given to the consideration of catheterism of the Eustachian tube, in which the author gives his new method of procedure in this operation. Before inserting the catheter, the operator is directed to place the instrument parallel with the zygomatic apophysis, a rounded prominence in front of the condyle of the lower jaw and the cheek of the subject, while its beak is placed as nearly as possible on a level with the zygomatic apophysis. Then there is to be marked on the catheter the distance between this apophysis and the anterior and inferior nasal spine. When the catheter is now passed into the nostril until the mark is reached, a slight rotation of the beak upward and outward is sufficient to put it into the mouth of the tube. It is claimed for this method that it obviates touching either the velum palati or the posterior wall of the pharynx.

The author now turns again to the anthropological study of the ear. "In studying the organ of hearing in animals, and especially among vertebrates, in comparing the various parts which enter into its development, it will be observed that some of these parts are constant, while others, subject to a law less fixed, are often annexed, as it were, for a new and subsidiary function, and then metamorphosed, and, in some cases, may even disappear entirely. In all these changes, however, the great function—hearing—remains intact. In general, then, the fundamental parts of the middle ear remain unchanged, as, for example, the membrana tympani, the chain of bones, and their muscles. But the form of the drum-cavity changes, as it is only a reservoir for air." This is the best argument, in the author's opinion, against the view held by many

that the drum-cavity is for resonance. Hence, the type of this air-chamber is not fixed, but is modified according to the exigencies and necessity of our higher order.

If the animal lives in the water, like the whale, or underground, like the mole, without the opportunity of renewing the air in its drum, it is endowed with a large middle-ear cavity—so large, in fact, that the two cavities unite at the base of the skull, where they are separated by a common wall. The ear of a man, however, is so completely supplied by a tubal apparatus for ventilation of the drum, as to be in no way comparable in form or capacity with that of other animals, as, for example, the bulla of the carnivores. The tympanum of a child just born is large and spacious, because it possesses no mastoid cavity. The adult's middle ear is, in general, narrower and more anfractuous, but the mastoid apophysis furnishes a large air-chamber in its cells.

But the mastoid apophysis is not simply an annex of the tympanic cavity; it should receive our attention as a bony eminence of great mechanical importance. The author then endeavors to answer the question, "What is this mechanical function?" Everything tends to aid man to maintain his vertical position. Every one knows that the muscles of the buttock and of the calf of the leg attain their maximum of development in man, for these are the muscles which extend the thigh upon the pelvis and the foot on the leg. Even the highest anthropoid apes are easily distinguished by the comparatively slender development of these muscles. Hence, they walk with their bodies inclined obliquely when on their hinder extremities. These differences of attitude in bipeds and quadrupeds imply great differences in the conditions of equilibration of the levers and organs of the body.

In man, when the head is lifted, the face looks forward and slightly upward, and it is balanced upon the condyles of the occipital bone. This equilibrium is necessarily unstable, because the centre of gravity is placed above the point of support; it is maintained, however, by the antagonism of the anterior and posterior cervical muscles. These act on a lever of the first class, whether they incline, lift up the face, or whether they turn to either side. The first two movements take place in the occipito-atloid joint. The point of support of the lever in this case is the occipital condyle. The length of the arm of the lever (if only the mechanism of rotation of the head is considered) is represented by the distance between the body of the occipital bone and the point of application of the power, viz., the mastoid apophysis. Its importance in man is at once seen, and also that the mastoid prominence lengthens the base of the power. In man the mastoid prominences are situated in the same vertical plane with the condyles of the occiput, and the orifice of the external auditory canal is in a plane a little anterior. In the inferior species of monkeys and in all animals who, as a rule, assume the quadruped attitude, the arrangement is entirely different. Take, for example, the dog; here no mastoid prominence exists; on the contrary, in its place there is a decided hollow.

Upon inspecting the base of the skull of the dog, we find that the occipital condyles are not on the same plane with the orifice of the auditory canal. It is seen, furthermore, that the occipital foramen is behind and not turned toward the ground; its plane forms a wide angle with that of the horizon, and nearly approaches the vertical position. At the same time, if the distance is measured between the transverse line passing through the anterior edge of the foramen, and a line uniting the external auditory foramina, it will be found that these lines are several centimetres apart.

In man only there are found on the same plane the point of support and the lever-power which effect the movement of rotation. In him the special proportions in the mastoid apophysis are concerned in the rotation of the head, and with his static and dynamic equilibrium. It can be concluded, from the comparison already made between man and the lower species most resembling him, that the predominance of volume in the mastoid region in man is both a new and important indication that the biped attitude is peculiar to him. And this characteristic may be added to other marked anatomical conditions pointed out by different authors to show that man's natural attitude is that known as the biped station.

In a separate chapter the objective snapping noise, called by the author the "bruit de Leudet," is spoken of at some length, but he is not prepared to say whether the noise is caused by movement of the membrana tympani or in the tubal muscles; both move simultaneously, however, in this noise.

The applications of the telephone and microphone in medicine are then spoken of, with the conclusion that, though the endeavors have been numerous, the results are meagre; though the author believes that these instruments will yet prove of great aid in medical diagnosis.

The chapter on "Pulsating Tumors of the Tympanic Cavity" is a review of the papers on this subject in this Journal, by Drs. R. F. Weir and A. H. Buck, of New York, and of similar observations by other writers not in France.

The author then refers to some experiments of his own on the functions of the Eustachian tube. The question propounded is whether "the Eustachian tube is constantly open, like the nostrils, or whether it is closed by the sticking together of its walls, like the urethra?" This is an important question in otology. The conclusion of the author is that the tube is closed in repose, but opens at each act of deglutition.

This highly commendable book closes with an extremely interesting chapter on the "Function of the Cochlea in Audition." The first statement of interest is that, according to Vulpian and Brown-Séquard, movements similar to those produced by wounding the semicircular canals may be produced by wounding the auditory nerve only. Then M. M. Duval showed that some of the fibres of the auditory nerves are closely connected with a collection of motor fibres in the bulb, and further, that these fibres are continued into the lower

peduncles of the cerebellum. It is known that lesions of these peduncles cause disturbances identical with those observed after wounding the semicircular canals. It is hence fair to conclude that in the acoustic nerve there are two kinds of fibres, and perhaps more, if we recall the trophic effects of injuries of the trigeminus in the bulb. The motor fibres of this nerve of special sense are distributed to the ampullæ of the semicircular canals, and connect them, as it were, with the bulb and the inferior cerebellar peduncle. The second part, spread out in the cochlea, the utricle, and the saccule, is exclusively sensory. If this second part of the auditory nerve is wounded, can it bring about motor disturbances or loss of hearing? These questions the author endeavors to solve by experiments on the cochlea of the guinea-pig.

The cochlea of this animal projects well into the bulla (its middle ear), and can be reached through the auditory canal, after the membrana tympani is punctured. After destroying the cochlea in this creature, it immediately walks, runs, and plays with the others as before, and eats, chews, and evinces not the slightest motor disturbance; it scarcely scratches its ear, so little does it notice the experiment. This shows that the cochlear portion of the auditory nerve possesses functions altogether different from those of the branch distributed to the semicircular canals.

Animals thus operated on, though showing no deafness at first, in the course of a few days or weeks show decided and great deafness.

The conclusion is that lesions of the cochlea occasion no motor disturbances, nor do they entail immediate deafness. The cochlea is not, therefore, the only and special organ of hearing. It seems that, so long as the vestibule remains intact, hearing remains; but what part the saccule, and what part the u ricle plays in this function, remains to be shown. But the author thinks that further post-mortem examinations on animals thus experimented on will decide these questions by showing which of these two sacs is the more invaded after the experiments, and the possible inflammation set up by the wound.

La Maladie de Ménière, et quelques Réflexions sur les Rapports du Mal de Mer et de la Maladie de Ménière. Thèse pour le Doctorat en Médecine. Par Palasne de Champeaux. Faculté de Médecine de Paris: 24 Février, 1881.

The etiology of the so-called Ménière's disease is considered as: 1st, primitive; 2d, traumatic; 3d, secondary. The latter is subdivided as: *a*, resulting from an affection of the ear, as otitis, foreign bodies, etc.; *b*, supervening in the course of a general affection, as rheumatism, fevers, the exanthemata, but especially syphilis and tuberculosis; *c*, by propagation, as in the otitis labyrinthica of children (Voltolini); and *d*, central causes, *i. e.*, from tabes dorsalis and diseases of the cerebellum. It is well known that the auditory nerve originates by two roots: one internal and deep—the bulbar root; the other exterior and superficial, from the floor of the fourth ventricle and the internal and deep

root, has intimate relations with the trigeminus through its bulbar root. In cases of tabes dorsalis, neuralgias of the trigeminus are not uncommon. Hence, it is not difficult to conceive that functional disturbances may take place in the tract of the auditory nerve, since the trigeminus is connected with its origin. Pierret is quoted as having observed, in some cases of tabes dorsalis, that with excessive pain in the trigeminus there are simultaneous tinnitus aurium and hardness of hearing, and in some instances there is vertigo. It would appear, then, that the author's conclusion is just "that the auditory nerve may in the course of tabes dorsalis give rise to aural symptoms varying in intensity from hardness of hearing to absolute deafness, from slight subjective noises to intense tinnitus aurium, and from moderate vertigo to vertiginous falling." This opens a most enticing field for observation.

The chapter on symptoms is very thorough, but contains little, if anything, unknown to the reader. Stress is laid on the fact that, during an attack of labyrinthic vertigo, there is never muscular contraction nor paralysis, that consciousness is preserved, but that the hearing is never so good as it was before the attack.

The writer distinguishes between simple aural vertigo and the so-called Ménière's disease. The first may be due to various aural diseases; the latter is due to irritation in the semicircular canals. There is given at page 37 a tabular view of the differential diagnosis between apoplectiform cerebral congestion and Ménière's disease. This disease is distinguished from the vertigo of epilepsy by the absence of the aura; from stomachal vertigo by the absence of epigastric pain, cramps, etc.; and from disease of the cerebellum by the fact that Ménière's disease appears in paroxysms, whereas cerebellar disease is continuous.

The most beneficial treatment is that proposed and carried out by Charcot, viz., large daily doses of quinine for a month, notwithstanding the apparent aggravation this drug brings about at first. At the end of a month suspend the treatment for fifteen days, and then proceed for a month with the quinine as before. Then pause for a fortnight or more, and resume a third time the quinine, if necessary. This is for the so-called regular forms of the disease.

M Dujardin-Beaumetz, acting upon the fact that sulphate of pelleterine possesses the property of inducing great congestion of the eye-ground, has used this drug in some cases of Ménière's disease, and in one case obtained great benefit. All the well-known experiments of the past fifty years, made upon the semicircular canals, are then reviewed, and the candidate feels justified in the following conclusion:

"The semicircular canals are the organs concerned in the maintenance of the equilibrium of the head, and consequently of the body, the auto-adaptive centre of which is in the cerebellum. The ideas thus gained are aided by vision, so that the head moves either with or without the movements of the

rest of the body. If the impressions furnished by the semicircular canals change, the auto-adaptive centres are informed, and regulate the movements necessary for the maintenance of the equilibrium of the head. If a lesion occur in the semicircular canals, it is expressed by disturbed equilibrium (which the vision endeavors in vain to correct, by movements always the same according to the canal affected), and at the same time by vertigo, which is the consentient, subjective hemisphero-cerebral expression of the perturbation of the auto-adaptive centre."

In tracing the resemblances between Ménière's disease and sea-sickness there should be noticed one great difference in the two sets of symptoms, viz., the absence of even temporary hardness of hearing in naupathy. It is claimed that sea-sickness is due to reflex congestion of the labyrinth, brought about by irritation in the abdominal organs by the motion of the ship. The pneumogastric nerve, at the point where it gives off the recurrent laryngeal nerve, supplies a nerve-filament passing to the inferior cervical ganglion. This direct connection between the pneumogastric and the cervical ganglion explains the relations existing between the stomach and the labyrinth, for the impressions transmitted by the stomach to the pneumogastric react on the ganglions and vasomotor nerves of the vertebral artery. It is, in fine, the compression of the endolymph by the engorged labyrinth blood-vessels supplied by the vertebral artery, which occasions the vertigo. The thesis closes with a recital of four illustrative cases.

REVIEWS.

The Production of Beats and Beat-Tones with Harmonic Intervals (*Ueber den Ursprung der Stösse und Stosstöne bei harmonischen Intervallen*). R. Koenig: *Wiedemann's Annalen*, No. 3, p. 335, 1881.—In beginning this article the author refers to the objections made by Helmholtz to his earlier experiments published in 1876, and proceeds to show that the beat-tones obtained by him could not have been due either to higher harmonic overtones produced in the air by the tuning-forks used, or in the ear itself by the influence of their powerful tones.

The first section of the paper considers the harmonic overtones produced by tuning-forks when strongly vibrated. In it Koenig states that the forks used by him in connection with resonators gave no perceptible harmonic overtones, as they had very thick prongs, which construction is unfavorable to the production of such overtones. Some interesting statements are made as to the effect obtained with forks of different relative dimensions. With thin prongs the production of harmonic overtones may be very evident.

In the second part of the paper it is shown that the beats which are noticed cannot be produced between the note of the sharper fork and a harmonic of the fundamental produced in the ear itself. In fact, the beats produced, for example, by an altered octave are so strong that, were they due to such a harmonic of the fundamental, they could not fail to be noticed in the tone of the fork when sounded alone. Also, in such a case, the fundamental would remain unchanged in intensity while the beats were heard. But this is not the case, as it is easily noticed that there are periodical variations in intensity.

The strong tones of tuning-forks were used by Koenig in his earlier experiments simply in order to make the beats and beat-tones evident even to an unpractised ear. But it is easy to recognize the same phenomena even with sounds of moderate intensity.

Stopped organ-pipes of large scale are especially useful for researches of this kind, on account of the feebleness of their overtones, and the fact that only the odd harmonics of the fundamental are produced directly by the pipes. But it is still possible that, on account of a deviation of the motion of the air-particles from a pendular vibration, other harmonics may be produced, as happens with tuning forks with thin prongs, when strongly vibrated. Such a deviation in the case of pipes may be caused by too strong wind-pressure.

A series of experiments is described in Part III. upon stopped-pipes of given

dimensions, blown with wind under a specified pressure. To study the harmonics, the ear, furnished with a resonator, is best placed at a node of one of the harmonics, formed by the meeting of direct and reflected waves, at which place the other harmonies are most readily heard.

With a stopped-pipe C (Ut), .07 m. broad, .088 m. deep, and about 1.15 m. long, blown by air under a pressure of .03 m. of water, the even harmonics Nos. 2 and 4 were not perceptible to the ear. The odd harmonics, Nos. 3 and 5, were heard, but the higher odd harmonics were absent. This pipe was, therefore, especially suited for experiments regarding beats of harmonics. It was found that beats were clearly produced with forks which were harmonics of C, both even and odd, up to the fourteenth.

In the fourth and concluding portion of the paper, an instrument is described for the further study of beats and beat-tones, to which the name "wave-siren" is given. In this instrument a stream of wind is blown through a narrow slit against a metal model which represents the form of any wave, being constructed by combining a series of sinusoids. This wave-form can be cut either upon the circumference of a wheel or on the edge of a metal band, which is then bent into a cylindrical form and attached to an axis about which it can be revolved. In the first case the slit through which the wind issues must be radial; in the second case, parallel with the axis of rotation of the cylindrical band. The general idea of this form of siren occurred to Koenig in 1867–68. A similar form has since been used by Terqueur and Töpler.

To apply the wave-siren to the study of beats and beat-tones, Koenig has constructed the resultant wave-curve for different intervals upon the circumference of a metal wheel, as already described. On rotating this before a radial slit through which air was blown, as the slit was more or less closed by the curved edge of the wheel, variations in the motions of the air-particles were produced, corresponding in form to the wave-curves cut upon the wheel. Hence, a motion was produced similar in form to that produced by the simultaneous sounding of two simple tones, free from overtones.

With such wheels beats were heard at a slow rate of rotation, and beat-tones at a higher rate. The pitch of these was determined by the use of tuning-forks. Thus, the second, 8:9, gave the lower beat-tone 1; the seventh, 8:15, gave the upper beat-tone 1; and the altered twelfth, 8:23, gave an upper beat-tone 1 of the second period very clearly. The intervals 8:11 and 8:13 gave the upper and lower beat-tones 3 and 5, 5 and 3 respectively. By having a series of holes made in the disk as with an ordinary polyphone-siren, which give the elementary and resultant beat-tones, these can be easily identified.

If several intervals are to be studied, the cylindrical form of the instrument is preferable. A figure is given showing four bands, which give eight intervals. An ordinary siren-plate is attached at the top, by which the elementary and beat-tones can be produced at will, as already described for the wheel-form of the instrument. By increasing the number of slits through

which the wind is blown, the intensity of the sound can be correspondingly increased. The slits must, of course, be suitably distributed about the circumference.

Though deviating slightly and necessarily from the theoretical conditions for perfect similarity in form between the wave cut upon the wheel and the resulting air-wave, still direct experiments with resonators show that, practically, the results reached are not open to any objection on this account.

A very interesting experiment illustrates this. If the wind-slit be slightly inclined to the radius of the wheel or to the axis of the cylinder, the form of the air-vibrations is of course altered, as the variations in intensity of the pulse of air are no longer proportional to the ordinates of the wave-curve. This must of course produce new overtones. It is found that a very slight inclination is sufficient to render this evident, so that it is even easy to adjust the slit by the ear alone, and when properly placed no foreign overtones are perceptible.

C. R. C.

Apparatus for Illustration of Beat-Tones in the Lecture-Room. *Beschreibung eines Stosstöneapparates für Volesungsversuche.* R. Koenig: *Wiedemann's Annalen*, No. 3, p. 250, 1881.—M. Koenig describes an apparatus for illustrating the phenomena of beat-tones to a numerous audience. High and low tuning-forks are objectionable for this purpose, because the intensity of the sound diminishes very rapidly. The author therefore first attempted the construction of an apparatus in which organ-pipes, with a peripheral embouchure like a locomotive-whistle, were used. But it was found that, even with very constant wind-pressure, it was hard to keep the pitch of the pipes absolutely constant. This proved a serious defect, since a very slight change in the pitch of the primary notes produces a great change in the resulting beat-tone. Thus, if the pitch of the second (8:9) rises by a tone to the major third (4:5), the beat-tone rises through an octave (1:2). For this reason the pipes, while serving to show the actual production of beat tones, do not furnish a suitable means of verifying the relation between these and their primaries.

The apparatus finally devised consists of two vertical glass tubes of suitable length, clamped at the middle point, and with the lower end of each pressed against a wheel. This wheel is covered with moistened cloth, so that on rotating it, the tubes are set into longitudinal vibration. The primary and beat-tones are then heard very clearly. As the tubes can readily be changed for others of different length, the apparatus is very convenient. Metallic rods can be substituted for the glass tubes, but they are not on the whole so satisfactory.

C. R. C.

On the Conversion of Radiant Energy into Sonorous Vibration. By W. H. Preece. Read before the Royal Society, March 10, 1881. *Telegraphic Journal,* April 1, 1881.—In this article Mr. Preece investigates the sounds pro-

duced when intermittent rays of light fall upon various hard substances, continuing the researches of Messrs. Bell and Tainter, Tyndall, and Mercadier. He first proves by direct experiment that ebonite is highly diathermanous, though there is a great difference among different specimens, and then proceeds to determine whether the effect is caused by an expansion and contraction of the disk, due to absorption and radiation, to a molecular pressure similar to that exercised in the radiometer, or to some other less evident cause.

Failing to obtain any evidence of elongation and contraction when an intermittent beam was allowed to fall upon a stretched wire, he began the investigation of a possible radiometric action, using disks either polished or coated with lamp-black. The experiments were at first inconclusive, but led to a question as to whether the disks themselves in Bell's experiments really vibrated at all. On attaching a delicate microphone to the case containing the disk, no effect was perceptible, which seemed to show that the disk was not the essential agent. It was next found that the cavity in which the disk was placed would give as loud or louder sounds when the disk was removed as when it was present, provided the interior of the cavity was blackened. A long series of experiments confirmed this result, and finally led Mr. Preece to the conclusion that the phenomena "is purely an effect of radiant heat, and it is essentially one due to the changes in volume of vapors and gases produced by the degradation and absorption of this heat in a confined space. The disks in Bell and Tainter's experiments must be diathermanous, and the better their character in this respect, the greater the effect; remove them, and the effect is greater still. . . . . The disks may, and perhaps do, under certain circumstances vibrate, but this vibration is feeble, and quite a secondary action. The sides of the containing vessel must possess the power to reduce the incipient rays to thermometric heat, and impart it to the vapor they confine, and the more their power in this respect, as when blackened by carbon, the greater the effect."

In a note, it is stated that Professor Stokes has suggested that the effect is due, not to an absorption of heat by the contained gas as a whole, but to the contact of the air-molecules with the absorptive surface, which increases their velocity as they rebound, and thus produces increased pressure. This causes an increase of volume, and if the action is rendered intermittent, sonorous vibrations result.

C. R. C.

Upon the Production of Sound by Radiant Energy. By A. G. Bell. Read before the Natural Academy of Sciences, April 21, 1881. *Silliman's Journal*, June, 1881.—Professor Bell describes a series of experiments of the same general nature as those of Mercadier, Tyndall, Röntgen, and others. When inclosed in a test-tube and submitted to the action of the intermittent beam of light,

cotton-wool, worsted, silk, and fibrous materials generally, were found to produce much louder sounds than rigid diaphragms. For the test-tubes, a conical brass receiver, closed by a flat plate of glass and furnished with a hearing-tube, was afterward substituted. As darker shades of colored worsteds produced the strongest effects, lamp-black in powder was placed in a test-tube, which, when submitted to the intermittent beams, gave a very startling effect. Various experiments of this kind are mentioned. It was found that if the beam was thrown into a resonator, the interior of which had been smoked over lamp, the most curious alternations of sound and silence were observed. When the rapidity of the intermissions was such as to give a note coinciding in pitch with that of the resonator, the sound was extremely loud.

An apparatus is described in which a photophonic receiver is constructed upon the principle under discussion. By this instrument speech was reproduced at a distance of forty metres.

The materials from which the loudest sounds are produced are cotton-wool, worsted, fibrous materials generally, cork, sponge, platinum and other metals in a spongy condition, and lamp-black. These sounds may be explained on the supposition that the alternate expansion and contraction of the particles of lamp-black, cause pulses in the air, which is squeezed out from among them like water from a sponge. This effect is increased by the expansion of the air itself, due to contact with the lamp-black. This also explains why the lamp-black communicates such a feeble vibration to the diaphragm on which it rests. Professor Bell disagrees with Mr. Preece in the conclusion of the latter gentleman that the disks in his experiments do not vibrate at all; because, if a sheet of hard rubber is used, the sound can be heard by placing the ear against any portion of the sheet. Also an intermittent beam thrown upon the diaphragm of a "Blake Transmitter" produces a musical tone in an attached telephonic receiver, though the wooden box and mouth-piece are removed. From this Mr. Bell concludes that "in the case of thin disks a real vibration of the diapnragm is caused by the action of the intermittent beam, independently of any expansion and contraction of the air confined in the cavity behind the diaphragm." Some interesting experiments are described by which this conclusion was verified.

A series of experiments with liquids and with gases is next described, with results similar to those of Röntgen and Tyndall.

Carbon has been found to be a possible substitute for selenium in an electrical photophone receiver.

An apparatus is described by which the relative sonorous effect produced by different substances can be approximately measured, after which the author proceeds to consider the nature of the rays producing the sonorous effect. He adopts the term "radiophony" proposed by Mercadier.

Using the sun as a source of light, with a bisulphide of carbon prism and a lamp-black receiver, sounds were obtained in all parts of the visible spec-

trum, except the extreme violet, as well as in the ultra-red, in which the maximum effect was produced. With a receiver filled with red worsted, the maximum effect was produced in the green; with green silk, the maximum was in the red; with hard rubber shavings, in the yellow; with vapor of sulphuric ether, in the ultra-red; and with iodine vapor, in the green. The conclusion is reached that the nature of the rays that produce sonorous effects in different substances depends upon the nature of the substances that are exposed to the beam, and that the sounds are in every case due to those rays of the spectrum that are absorbed by the body.

The paper concludes with a description of the spectrophone, an instrument similar to a spectroscope, in which for the telescope a radiophonic receiver is substituted, and some experiments with it are described.

Besides the articles on the subject of radiophony that have been mentioned in the JOURNAL OF OTOLOGY, the following are valuable: "Notes on Radiophony": Mercadier, *Comptes Rendus*, Dec. 6 and 13, 1880; Feb. 21 and 28, 1881; and *Journal de Physique*, April, 1881. "On the Tones which arise from the Intermittent Radiation of a Gas": Röntgen, *Wiedemann's Annalen*, Jan., 1881.

C. R. C.

ON THE APPLICATION OF THE TUNING-FORK TO THE STUDY OF THE PROPAGATION OF SOUND AND VIBRATORY MOTIONS IN LIQUIDS. (*Note sur l'Application du Diapason à l'Étude de la Propagation du Son et des Mouvements Vibratoires dans les Liquides*) CH. MONTIGNY: *Bull de l'Académie Royale des Sciences de Belgique*, No. 12, p. 800, 1880.—In this note the author continues the study of the influence exercised by liquids upon the vibrations of sonorous bodies. A tuning-fork, kept in vibration by electricity, is immersed in the liquid. As the prongs are sunk more deeply the pitch falls, though this effect is less sensible beyond the point when they are half immersed.

The fork resounds well in pure water, ether, alcohol, bisulphide of carbon, glycerine, and salt water. In pure water the sound is more grave than in alcohol or ether. The lowering of pitch is more marked in salt water, and especially in bisulphide of carbon, that is, in proportion as the liquid is more dense. This agrees with the results of previous experiments on bells filled with liquids or immersed in them. Mercury lowers the sound greatly. In these researches it is convenient to reinforce the sound by a suitable resonating-box of variable size, attached to the stem of the fork.

Montigny remarks upon the continuous waves produced in liquids by this means, and proceeds to indicate the direction in which he is prosecuting his experiments. The particular object of his present studies is to determine the changes in the intensity of sound-waves which are transmitted through two or more liquid media of different densities.

C. R. C.

St. Bartholomew's Hospital Reports, Vol. XVI., p. 267, 1880. *Aural Exostoses.*—Cumberbatch reports two cases of aural exostosis. In speaking of the etiology of such tumors, he says: "They are most frequently situated in the posterior superior wall of the meatus, near the membrane, generally two in number." In all cases but two that he has seen, the deafness associated with each case has been due to a concomitant disease of the middle ear, and generally catarrhal in character. The patients affected generally were of a gouty diathesis, and middle-aged. In regard to treatment, he recommends that no operative interference with these growths be undertaken, unless they cause retention of secretion. When complete obstruction exists, he thinks that the final closure is due more to the swollen condition of the skin of the meatus than to any increase in the size of the tumor; therefore, if the skin over the exostosis could be replaced by a thin cicatricial tissue, the swelling at each attack of catarrh would be prevented. In support of this theory he records two cases:

B. J., seen in September, 1876. Before coming under observation, patient had an attack of purulent catarrh of both tympana, with deafness; a polypus was removed from the left ear; after a short time he recovered from this attack. When examined, the following was the condition of both ears: right meatus, much narrowed, about one-half; skin of meatus congested and swollen; membrane imperfectly seen, but no perforation detected. Left meatus, a single exostosis on posterior wall; skin also very vascular and swollen. On right side, hearing normal; but on left, when pressed only can the watch be heard. Patient also has naso-pharyngeal catarrh. Under suitable treatment the catarrh was benefited, and it was decided to apply nitric acid to the swollen skin covering the tumor. Ether was given, and every part of the tumor was touched with the acid, and then washed with a solution of soda. The next day the meatus was occluded by the inflammatory swelling. When the slough came away and the surface healed, the space between the exostosis and the anterior wall was much increased. Patient has been under observation for some time, but the cicatrix has prevented the occlusion, though the exostosis has not increased in size.

In another case of exostosis the nitric acid was applied as before, and the space was also much increased in the meatus, and the patient much benefited by it.

Aural Affections in the Acute Exanthemata. *Archiv für Ohrenheilkunde*, Vol. XVI., p. 16. Gottstein.—Attention is called to the rarity of observations by competent observers of the earlier stages of the ear diseases which occur during the exanthemata. From the statistics of Burckhardt-Merian it is seen that of all the cases of ear disease which were referred to the exanthemata, but sixteen to eighteen per cent. were seen within the first six months of their development, and Gottstein's own statistics are not any more favorable for the observation of the acute stages of disease, and for the determination of the

question of how the great destruction which is so often seen in such cases occurs. Wreden, of St. Petersburg, from his connection with the large children's hospital of that city, had most unusual opportunities for early observations; he has reported diphtheritic inflammation of the middle ear as very common in scarlet fever, but his observations have not been confirmed by others, as Gottstein thinks, owing to the ear disease being seen only in its later stages. According to Wreden, the diphtheritic exudation continues only for fourteen days and is succeeded by suppuration, the stage in which the disease usually comes under treatment.

As contributions to this subject, Gottstein narrates three cases: one of croupous inflammation of the velum, pharynx, nose, and both middle ears, in the second week of scarlet fever; one of diphtheria of the throat, with diphtheritic inflammation of the left tympanum, in the second week of measles; and one of acute desquamative inflammation of both tympanic membranes, with perforating tympanic inflammation, in the course of measles. In the first case, two days after the appearance of diphtheritic membranes in the pharynx and nose, great deafness was noticed, and examination showed diphtheritic membranes over both drum-heads, which were already perforated, and the same exudation covered the tympanic mucous membrane. From the history, the presence of membrane first in the nose and later within the tympanum, Gottstein concludes that the exudative process extended up through the Eustachian tube to the tympanum, and produced the destruction from within outward.

In the second case, soon after the appearance of diphtheritic membranes on the uvula, palate, and tonsils, great deafness without pain or discharge was noticed in the left ear, and the deeper meatus was found to be covered with similar membrane. After removal of this, the membrana tympani was found perforated and the tympanic cavity in a state of suppuration, but without any membranous deposit, and Gottstein feels uncertain whether the exudation of the ear was an extension from the pharynx or was an independent deposit.

In the third case the deposits in the ears were taken for diphtheritic membranes, till the microscope showed that they were composed of epidermal cells, and not of a fibrinous exudation.

In regard to the treatment of diphtheria, Gottstein has never seen the diphtheritic process shortened by cauterization, and considers that therapeutic efforts should be directed to removal of the exudation and to disinfection of the mucous membrane. He advises prolonged baths in aqua calcis, and powdering the diseased surfaces, after removal of the membranes, with salicylic acid.

Diabetic Otitis: Clinical Lecture at La Charité, Paris. By Maurice Raynaud, Member of the Academy of Medicine. *Annales des Maladies de l'Oreille*, etc. March, 1881.—The opinion expressed in this clinical lecture is that diabetic otitis is not only more frequent than is supposed, but that when

it has once become well known it may prove a pathognomonic index, like anthrax, diffuse phlegmon, and certain erythematous eruptions about the genitals, and arouse the suspicion of the presence of this disease, hitherto unsuspected.

In a case of well-marked diabetes mellitus, in which an attack of anasarca was diminishing, there suddenly occurred one eveniug, after the patient had been in the hospital a fortnight, a violent attack of pain in the right ear. There was no assignable cause, no chilling to account for this. The pain became intense in the extreme, and toward midnight of the evening when attacked there occurred an abundant hemorrhage from the right auditory canal, which was followed immediately by relief.

The next morning there ran from the ear a copious sero-sanguinolent fluid, which flowed steadily, drop by drop, to such an extent as to require to be caught in a vessel. This discharge continued for several days, the liquid growing paler until it became serous. Under the microscope it showed leucocytes, which collected in small quantity at the bottom of the vessel, and it contained albumen, as shown by heat, but no sugar.

By examining the fundus of the canal with the otoscope, it was seen that the membrane was covered with a whitish exudation, pseudo-membranous in appearance, and in its upper part the fluid was seen to come through a small perforatiou. There was deafness on this side. In ten days the discharge ceased until it became a mere moisture, which, however, persisted until the death of the patient, twenty-three days after the attack of earache. The petrous bone was examined post-mortem by Dr. Ladreit de Lacharrière, who discovered a large perforation in the anterior segment of the membrana tympani; red, fungous, and bleeding mucous membrane in the drum-cavity, in which there was a pink and purulent liquid.

The bones of the ear were not dislocated, but they were embedded in the granulations, and near the stirrup there was a clot of blood. The mastoid cells were filled with a rose-colored liquid containing pus-cells, and the mucous membrane lining the mastoid cells was red and softened. The osseous substance was greatly injected, marbled at some places, and presented all the appearances of inflammation of bone-tissue. The vestibule, the cochlea, and the semicircular canal showed no alterations. The ostitis in the mastoid is dwelt on as the sign of greatest importance, for the writer concludes that ostitis in the petrous bone is a peculiar and constant characteristic in diabetic otitis, though the latter may not pass beyond the mucous membrane.

The Action of Constant Electric Currents upon Certain Affections of the Internal Ear. By Dr. Ladreit de Lacharrière, *Annales des Maladies de l'Oreille et du Larynx*, September, 1880.—For a long time it has been thought that electricity could revive the auditory sense, which was, indeed, a natural view to take of the action of an excitant so powerful in other dis-

eased states of the nervous system. It was therefore held that electricity could cure a deafness dependent simply on a weakness of the auditory nerve; but under the name of nervous deafness there was confounded a number of different pathological states. Whenever it was found that the various parts in the middle ear were healthy, the hypothesis of an affection in the labyrinth was used to explain a nervous deafness, though the affections of the labyrinth are admitted to vary with the conditions under which they are evoked.

The application of electricity under these conditions, in a purely empirical manner, would give, of course, variable results. The great divergence of opinion in these cases is due to the fact that the observers have been more attentive to the mere fact of deafness than to the causes producing it.

The author has asked himself, therefore, this question: May there not be in a number of cases of deafness produced by very different causes, as, for example, hysteria, the administratiou of large doses of quinine and salicylate of soda, and, after certain fevers, a similar pathological state characterized by disturbances of the vaso-motor nerves? This is a question, however, often propounded before by many observers, as the author must know, though there is no special evidence of such knowledge.

This principle of observation being admitted, the author believes he can often connect diseases of the ear, both chronic and acute, with both temporary and organic disorders of digestion. Also, he has observed similar connections between aural affections and vesicular eruptions, like herpes, which usually supervenes upon hepatic troubles, and a similar connection between various congestive states due to diathesis or a neurosis, and also a connection with uterine phenomena and aural disease.

Therefore, there are certain vaso-paralytic conditions which enable us to explain a certain number of morbid states of the ear which cannot be accounted for by the appearance of the drum, nor of the chain of auditory bones. The application of electric currents in these conditions, by arousing the contractility of the vascular coats, breaks up this stasis of the blood and the passive congestion. Several illustrative cases are then given, and the method of application of the electric currents, as practised by the writer, are then detailed.

The batteries which he has used are such as give out a constant current, and those made by Gaiffe are the most suitable. He has had made rheophores, nipple-shaped in the centre, so that this prominence would fill the orifice of the auditory canal. These are first moistened and then placed one in each ear, and held in position by a double spring. The author considers that it is an essential in the electrization of the internal ear that the current of electricity should pass across the base of the skull. For, if one of the electrodes should be placed on the nucha while the other is in the auditory canal filled with water, there is no reason to suppose that the electric current passes through the labyrinth; but, if it is made to pass through the base of the skull, the inner ear is acted upon in all its parts. The author admits that the electric current

is direct in this instance without accuracy, and that it acts on all the portions of the petrous bones, so that thus the chorda tympani is irritated and brings about an increased flow of saliva, while at the same time the patient experiences a peculiar taste in his mouth. If, now, the current is suddenly and actively interrupted, the patient perceives a flash of light, which shows that the optic chiasm has been excited. The author has never met with any accident in thus applying the current, and by not prolonging the séance beyond five minutes the patient has not been exposed to vertigo or syncope. Should the latter threaten, the current must be stopped at once. No more than eighteen elements of Gaiffe's battery have been found necessary, and, in fact, the patient could not endure a more intense current. In general, twelve to fourteen elements will be enough.

The employment of constant electric currents in cases of simple weakness of the acoustic nerves has always been attended with good results in the author's cases. This practice is one generally employed, and offers nothing new, as the author says; but he has felt it his duty to mention his experiences. He wishes to emphasize two conditions:

1. That there are morbid states of the ear which are characterized by a passive congestion of the labyrinth determined by a weakness of the vaso-motor nerve.

2. That constant electric currents, employed as he has shown, constitute a therapeutic means of great efficacy in modifying these pathological states, checking the tinnitus aurium and vertigo accompanying them, and in restoring the hearing.

NERVE-ATROPHY IN THE FIRST COCHLEAR CONVOLUTION. MOOS and STEINBRÜGGE: *Archives of Otology*, Vol. X., No. 1.—A case of great interest in pathological physiology is described. A man, aged sixty-three, suffered from disease of the brain, and the clinical diagnosis was hemiparesis lateralis sinistra from a cortical affection of the right central convolution; the autopsy showed carcinoma of the anterior central convolution, and also carcinoma of the stomach. The patient was extremely deaf, the voice not being heard at all on the right side, and at a distance of three metres only on the left side. Two weeks before death, an examination of the ears showed normal appearances, but testing proved that the perception for high tones was entirely lost.

Tuning-forks from the forehead gave as follows:

$a' = 440$	was perceived.	
$c' = 264$	"	right.
$c = 132$	"	"

Tuning-forks by air-conduction gave:

Right.	Left.
$a' = 440 = 0.$	$a' =$ barely heard.
$c' = 264 = 0.$	$c' = 0.05$ metre.
$c = 132 = 0.01$ metre.	$c = 0.01$ "

Microscopic examination of the right labyrinth showed that the central termination and the trunk of the acoustic nerve were generally normal, but contained a few atrophic fibres. A further examination of the different convolutions of the lamina spiralis proved that the nerve-fibres in the two upper convolutions were perfectly normal, while those in the first or lower convolution had undergone a very marked quantitative atrophy. The hair-cells were similarly affected, the inner ones of the first convolution showing only a finely granular, molecular, colorless mass; the cells in the second convolution were nearly normal, while those in the third were absolutely so.

The cause of the disease—a nerve-atrophy from inactivity or intra-labyrinthine pressure produced by fixation of the stapes, as argued by the authors—we cannot accept as proven; but the loss of perception for high notes, associated with the nerve-atrophy of the lower cochlear convolution, is a pathologico-histological demonstration of Helmholtz's theory of tone-perception very unique and of great interest.

As is well known from the laws of the transmission of vibrations and the study of the structure of the labyrinth, Helmholtz concluded that the cochlea was a stringed instrument, with strings of graduated variable length, the longer corresponding to the lower tones, and the shorter to the higher tones; and as, from the measurements of Hensen, the radial length of the lamina basilaris membranacea increases from below upward to the cupola of the cochlea, the lower convolution of the cochlea is adapted for the perception of the higher notes.

The functional test in this case, in connection with the pathological condition of the first cochlear convolution, is in full harmony with this theory of Helmholtz.

Aural Polypi and their Treatment. R. Voltolini: *Monatschrift für Ohrenheilkunde*, No. 2, 1881.—Voltolini reasserts what he has already written, that in the treatment of aural polypi he prefers the use of the galvano-caustic. For the simple removal of the growth, he uses a wire snare—cold, if the polypus is soft; but if he finds it hard, he attaches the battery and burns it off by galvano-cautery. For future cauterizations of the base he always uses the galvano-cautery, and in this article gives a figure of the finely pointed instrument he prefers.

Statistical Report of the Policlinic for Aural Disease in Halle A.-S., from Oct., 1879, to Oct., 1880. *Ibid.* Hessler.—Here also full tables of diseases, sex, and age are given, which can only be studied in the original; the only criticism of them would be that both these and the preceding tables would gain in clearness for reference if they were divided according to the anatomy of the ear.

Hessler of Halle A.-S. follows his report by very thorough reports of the unusual and noticeable cases which were presented.

Fracture at the Base of the Skull. (Prof. George Buchanan's Wards, Glasgow Hospital.) *Glasgow Medical Journal.*—Shortly before admission, the patient fell a distance of twenty feet, and an iron column upon which he was at work fell with and upon him, striking him on the head. He complained of pain in the right temporal region, was not comatose, but stupid, and bled from the right ear and posterior nares, there being a watery fluid mingled with the flow of blood from the ear. Facial paralysis of the right side, with impaired hearing, were the most marked symptoms in the case. The hemorrhage continued for two days, at the end of which time the patient was able to recall the particulars of the accident, and gradually improved in general condition. The ear, however, continued to discharge a transparent, yellowish fluid, and a rupture of the membrana tympani was distinctly discernible. The fluid was examined and concluded to be cerebro-spinal. Six weeks after the accident the man was discharged from the ward, and subsequently treated as an out-patient. The ear continued to flow, the discharge becoming purulent, and gradually ceasing under the use of zinc instillations and inflation of the middle ear.

After recovery, the vibrating tuning-fork upon the forehead was heard much better in the affected ear. The facial paralysis and the general symptoms gradually disappeared.

This case suggests the importance of a careful and skilled examination of the ear in supposed fracture of the base of the skull, where the ear is implicated. The symptoms in this case, so far as can be judged from a report, would have been fully explained by injury to the middle ear alone, the free and continued watery discharge being in itself no evidence of implication of the cranial cavity. In default of the possibility of chemically determining the distinction between the cerebro-spinal fluid and the serum so copiously and continuously poured forth in cases of extreme congestion of the mucous membrane of the tympanic cavity following injury, the careful, expert examination of the ear is imperative.

Summary of the Otiatric University-Clinic of Prof. Zaufal for 1879. *Archiv für Ohrenheilkunde*, Vol. XVI. Habermann.—Full tables are given of the different diseases, which it is impossible to condense; the sex, occupation, and the exact organ affected are also stated, with remarks upon the interesting features of the various diseases, as presented by the subjects seen.

A Disinfecting Capsule for the Common Air-Douche. *Archiv für Ohrenheilkunde*, Vol. XVI. Zaufal.—To diminish the risk of infection from the use of the balloon in different patients, it is suggested that the air be filtered by passing through a hollow globe attached to whatever form of apparatus is used, the interior of this globe being filled with disinfecting substances.

THAULOW: BEHANDLING AF OTORRHŒA: *Norsk. Magaz. for Läger.*, R. No. III., Bd. X. (Treatment of Otorrhœa).—Thaulow follows the dry method of treatment in otorrhœa, for which he uses tampons saturated with a strong solution of boracic acid. Both secretions and fœtor are greatly diminished by these applications. In addition, Politzer's air-bag or the catheter. The repeated syringing is condemned as useless and often harmful, on account of its causing eczema of the meatus, and because, with small perforations of the membrana tympani, it is not possible to cleanse the tympanic cavity. (Referat in *Nordiskt Medicinskt Archiv*, XII., No. 4, by C. Ragge.) J. J. B. V.

OTOSCOPIC FORCEPS OF DR. VERDOS. Otoscopo prensor del Dr. Verdos: *Revista de Medicina y Cirugia prácticas.* Madrid, IV., No. 90.—This instrument, intended for the removal of foreign bodies and polypi from the meatus auditorius externus, was described in the *Revista de Ciencias Médicas.* The otoscopic part consists of Brunton's otoscope, with a modification in the auricular extremity. This can turn easily on the other part, and in its border runs the articulation for a pair of conical forceps, the handles of which are turned downward. This instrument, the author claims, performs the double function of otoscope and of forceps, so that every movement of the forceps in the meatus can be strictly watched, and can be used in any direction by the easy rotation of the auricular part of the otoscope to which they are attached.
J. J. B. V.

R. MALLING-HANSEN. Forslag om at oprette et Dörstumme-Institut i Jylland. Köbenhavn, 1880. (Plan for the creation of an institution for deaf-mutes in Jutland).—L. W. Salomonsen, Oprettelsen af et Dörstumme-Institut i Jylland. *Ugeskrift for Läger*, R. IV., Bd. I.; 174.

Malling Hansen, the director of the Royal Institute for Deaf-Mutes in Copenhagen, has proposed the erection of a government institution in Jutland, for instruction of one hundred, and boarding of thirty to fifty deaf-mutes. To this institution should be admitted every year the different deaf-mutes of eight years of age; and, after a certain term of probation, such deaf-mutes as would show aptitude to learn speech should remain in the Jutland institution, where the method of visible speech should be taught, while the others should be transferred to the institution in Copenhagen, where the method of signs would be followed.

Salomonsen in his article gives a short report of the development of instruction of deaf-mutes in Denmark. He favors compulsory education for all deaf-mutes, and separates them in real and unreal deaf-mutes, and agrees with the preceding author in that a large proportion of the deaf-mutes proper (nearly fifty per cent.) can be taught by methods of speech. (Referat by Joh. Möller, in *Nordiskt Medicinskt Archiv*, XII., No. 3.) J. J. B. V.

BIBLIOGRAPHICAL INDEX.

Books.

"Inflammation, Chiefly of the Middle Ear, and Other Diseases of the Ear." R. A. Cooper. Second edition. 8vo. London, 1881.

"Lectures on Diseases and Injuries of the Ear, Delivered at St. George's Hospital." W. B. Dalby. Second edition. 8vo, pp. 239. London, 1880.

"VIII. Anno di Insegnamento della Otojatria. Cenni Statistico-clinici per l'Anno Scolastico 1878–79." E. de Rossi. Roma, Civelli, 1879. Arch. f. Ohrenh., XVII., 1 and 2, 1881.

"IX. Anno di Insegnamento della Otojatria. Cenni Statistico-clinici per l'Anno Scolastico 1879–80." E. de Rossi. 8vo. Roma, 1880.

"Hearing, and How to Keep it." 12mo. London, 1881.

"Contribution à l'Étude des Symptômes, du Diagnostic et de la Pathogénie de la Maladie de Ménière. Quelques Réflexions sur les Rapports du Mal de Mer et de la Maladie de Ménière." F. P. Palasne de Champeaux. 4to, pp. 85. Paris, 1881.

"De doofstomheid van een geneeskundig standpunt beschonrod. (Vrij-bewerkt naar Hartmann's 'Taubstummheit und Taubstummenbildung')." J. Schoondermark. 8vo. Rotterdam, 1881.

"Imperfect Hearing and the Hygiene of the Ear, Including Nervous Symptoms, Tinnitus Aurium, Aural Vertigo, Diseases of the Naso-Pharyngeal Membrane, Middle Ear, and Mastoid Region; with Home Instruction of the Deaf." L. Turnbull. Third edition. 8vo, pp. 159. Philadelphia.

"Note sur une Cause peu connue du Bourdonnement d'Oreille." Boudet de Paris. 8vo. Paris, 1881.

"Du Traitement de l'Otorrhée Purulente Chronique. Quelques Considérations sur la Maladie de Ménière. Mémoires lus au Deuxième Congrès Otologique International, tenu à Milan en Septembre, 1880." Émile Ménière. 8vo, pp. 46. Germer-Baillière: Paris, 1880.

Journals.

External Ear.

"Foreign Bodies in the Ear," Almer: London Lancet, Feb. 12, 1881.

"Instrument for the Application of Wool, etc., to Cavities," Anonymous: London Lancet, Jan. 29, 1881.

"Corpo Extranho de Ouvido. Morte am Seguida a Tentativas Repetidas de Extracçao," Anonymous: Correio Med. de Lisbon, Jan. 15, 1881.

"Foreign Body in the External Auditory Meatus; Strange Nervous Symptoms; Relieved by Removal of the Foreign Body," Anonymous: Trans. American Med. Association, XXXI., p. 679, 1880.

"Effects of Ear-Piercing," Anonymous: Louisville Medical News, Feb. 19, 1881.

"Eczema of the Ear," W. R. Arnwick: Cincinnati Medical News, March, 1881.

"Some Points on Cleansing the Ear," W. H. Bennett: New York Medical Record, May 26, 1881.

"Ueber Ohrpolypen und deren Behandlung," A. Bing: Mitth. d. Ver. d. Aerzte in Med.-Oest., Wien, VII., 95.

"Traitement de l'Otorrhée sans Lésion Osseuse," Brisson: Journal de Méd. et Chir. Prat., Paris, Feb., 1881; Chicago Medical Review, April 5, 1881.

"Cases of Foreign Bodies in the External Meatus Treated in the Hospital," J. P. Cassels: Specialist, p. 84, I., London, 1880–81.

"De l'Extraction des Corps Étrangers du Conduit Auditif Externe," Catrin: Gaz. Hebd. de Méd., Paris, Jan. 14, 1881.

"Suites de l'Opération du Perecment du Lobule de l'Oreille chez les Scrofules," P. Constantin: France Méd., Paris, Jan. 18, 1881.

"Two Cases of Exostosis," A. E. Cumberbach: Report St. Bartholomew's Hospital, XVI., p. 267, 1880.

"Escape of Worms by the External Meatus," J. Dickson: London Lancet, Jan. 8, 1881.

"Foreign Body in the Ear," J. C. Fear: Med. Brief, Jan. 1, 1881.

"The Treatment of Othæmatoma," J. O. Green: Boston Med. and Surg. Journal, Braithwaite, March, 1881.

"On a Peculiar Exostosis in the Ear," A. Hedinger, translated by I. Furst: Archives of Otology, March, 1881.

"Fall von Cholesteatom," H. Hessler: Arch. f. Ohrenh., XVII., 43, Leipzig, 1881.

"Noma of the Ear, Successfully Treated by Cauterization," J. Hutchinson: Med. Times and Gaz., London, Jan. 22, 1881.

"Epilepsy from Foreign Bodies in the Ear," L. Katz: Presse Méd. Belge. Brux.; Maryland Med. Journal, Feb. 1, 1881.

"Keloid of the Extremity of the Ear," A. Key: Phila. Med. Times, April 9, 1881.

"Parasitic Fungi in the Human Ear," read at the Congress of Rheims of the Assoc. Franç., 1880, Loewenburg: Gaz. 36, Hebd., 1880; Arch. f. Ohrenh., XVII., 1 and 2, 1881.

"Fremden Körper des Ohres," Lucac: Real-Encyclop. der gesam. Heilkunde, V., 45 and 46.

"Otorrhée," Ménière: Bull. Acad. de Méd., Paris, Feb. 15, 1881.

"Treatment of Othæmatomata," W. Meyer: Arch. f. Ohrenh., XVI., 161.

"Anatomo-Pathological Conditions in a Case of Malformation of the Right Ear," S. Moos and H. Steinbrügge, translated by I. Furst: Archives of Otology, March, 1881; Zeitsch. f. Ohrenh., X., 1, 15; Arch. f. Ohrenh., XVII., 1 and 2, 1881.

"Sull' Uso dello Spirito di Vino Rettificatissimo nell Trattamento delle Granulazioni e deli Polipi degli Orrechio," E. Morpurgo: Speriméntale, XLVII., 137, Firenze, 1881.

"Application of Chloroform to the Membrana Tympani," J. L. Moyar: Louisville Med. News, Feb. 26, 1881.

"Case of Occlusion of External Auditory Meatus," A. F. Palacios: Revista de Med. y Cir. Prác., T. VII., 99..

"Eczema des Oreilles," C. Paul: Progrès Méd., Paris, Jan. 29, 1881.

"Injury from Ear-Rings," Med. and Surg. Reporter, Philadelphia, March 26, 1881.

"Foreign Bodies in the Nose and Ear, with Remarks on their Removal," E. S. Peck: Amer. Journal Obstet., Jan., 1881.

"Treatment of Polypi of the Ear," A. Politzer: Wien. Med. Wochnschr., July 31, 1880; Amer. Jour. Med. Science, Jan., 1881; New York Med. Rec., Jan. 8, 1881; Cincinnati Lancet and Clinic, March 19, 1881; Glasgow Med. Jour.; Med. and Surg. Reporter, Philadelphia, Jan. 15, 1881; London Med. Rec., Jan. 15, 1881; Med. News and Abstr., March, 1881; Practitioner, London, Feb., 1881; Ann. des Mal. de l'Oreille, du Larynx, etc., May, 1881.

"Perichondritis Auriculæ," T. R. Pooley: New York Med. Rec., March 19, 1881.

"Impacted Cerumen, Tinnitus Aurium, Simulating Early Symptoms of Locomotor Ataxia," S. D. Risley: Trans. Amer. Med. Association, Philadelphia, XXXI., p. 680, 1880.

"The Abuse of Silver Nitrate and Blisters in Eye and Ear Diseases," E. C. Rivers: Maryland Med. Jour., Baltimore, May 1, 1881.

"Bleeding from the External Auditory Passages, from Erosion of the Internal Carotid," Solkowsky: Philadelphia Med. Times, March 26, 1881; Centralbl. f. Clin., Leipzig, 1881.

"The Dry Method of Treatment of Discharges from the Ear," C. A. Todd: Trans. Med. Assoc., Missouri, 1880.

"Rare Case of Otitis Externa Parasitica," R. Torrance: Brit. Med. Jour., Oct. 9, 1880.

"Artificial Membrana Tympani," L. S. Turnbull: Med. and Surg. Reporter, Philadelphia, March 5, 1881.

"Corps Étrangers," Verneuil: France Méd., Paris, Jan. 29, 1881; Med. and Surg. Reporter, Philadelphia, Feb. 26, 1881; Bull. et Mém. Soc. de Clin., Paris, March 5, 1881.

"De l'Otite Catarrhale dans la Fièvre des Foins," Giffo Vierre: Ann. des Mal. de l'Oreille, 297, 1879; Arch. f. Ohrenh., XVII., 1 and 2, 1881.

"Ueber Ohrpolypen und deren Behandlung," R. Voltolini: Monatsch. f. Ohrenh., Feb., 1881.

"Circumscirpte desquamative Entzündung des äusseren Gehörganges," Weil: Montatsch. f. Ohrenh., March, 1881.

"Foreign Bodies in the Ear," T. G. White: London Lancet, Feb. 5, 1881.

"Fremdenkörper im Ohre," E. Zaufal: Wien. med. Presse, XXII., 80, 1881.

"Blutung aus den Ohren bei einer Selbsteıdrosselten," E. Zillner: Wien. Med. Wochensch., 35 and 36, 1880; Arch. f. Ohrenh., XVII., 1 and 2, 1881.

Middle Ear.

"Three Cases of Rupture of the Membrana Tympani," Agnew: New York Med. Rec., XVIII., 169.

"Traumatische Ruptur eine sin Folge Chronisch ein sklerosirenden Mittelohr-Katarrhs verdickten Trommelfels," ———: Arch. f. Ohrenh., XVII., 52.

"Inflammation of the Middle Ear and Mastoid Cells," W. R. Arnwick: Cincinnati Med. News, Jan., 1881.

"Inflammation of the Mastoid Bone, followed by Abscess in the Cerebellum," W. H. Bennett: St. George's Hosp. Rep., X., 71, 1879. London, 1880.

"On the Influence of the Nerves of the Tympanic Cavity upon the Secretion of its Mucous Membrane," E. Berthold: Trans. Fifty-third Cong. Gen. Sci. and Phys.

"On the History of Myringitis," A. Bing: Wien. m. Blätter, 30 and 39, 1880.

"Middle-ear Disease in Children, in the Course of the Acute Exanthemata," C. J. Blake: Boston Med. and Surg. Jour., May 19, 1881.

"On the Movements of the Musculus Tensor Tympani in the Dog," Bockendahl: Arch. f. Ohrenh., XVI., part 4.

"Sur quelques États du Tympan, qui provoquent des Phénomènes Nerveux," Bonnafont: Ann. des Mal. de l'Oreille, 311, 1879; Arch. f. Ohrenh., XVII., 1 and 2, 1881.

"On the Treatment of Non-suppurative Hypertrophic Catarrh of the Middle Ear, with Especial Reference to the Employment of Intra-tympanic Injections," L. Browne: Specialist, London, 1, 32, 46, 60, 1880–1881.

"Disease of the Mastoid Cells," F. Buller: Canada Med. and Surg. Jour., Toronto, Dec., 1880; Detroit Lancet, March, 1881.

"Cases of Disease of the Mastoid Bone, Treated in the Hospital," Cassels: Glasgow Med. Jour., XV., 223, 1881.

"Otitis Media and Otitis Media Purulenta Acuta, Caused by the Use of the Galvano-cautery in the Naso-pharynx," W. Daly: Trans. Amer. Med. Assoc., 1880.

"Purulent Otitis Media with Cerebral Abscess," Frankel: New York Med. Jour., Jan., 1881; Braithwaite, March, 1881.

"Étude des Mouvements du Tympan par la Méthode Graphique," Gelte: Compt. Rend. Soc. de Biol., 1878, V., 261, 304. Paris, 1880.

"Étude Experimentelle de la Fonction de la Trompe d'Eustache," Gelte: Acad. de Méd., Paris, Séance of June 22, 1880.

"Nouveau Tympan Artificiel," Giampetro (de Naples): Ann. des Mal. de Oreille, du Larynx, etc., May, 1881.

"Ueber Durchschneidung der hinteren Trommelfalte zu Heilzwecken," Gruber: Allg. Wien. med. Zeitung, XII., 1881.

"The Therapeutical Value of the Injection of Medicated Fluids through the Eustachian Tube," J. Gruber: Monatschr. f. Ohrenh., XIV., 9, 1880; Buffalo Med. and Surg. Jour., May, 1881; Arch. f. Ohrenh., XVII., 1 and 2, 1881.

"On Some New Methods of Treating Otorrhœa," J. Gruber: Allg. Wien. med. Zeit., 28 and 29, 1880.

"Fall von primärer Caries des Hammers," H. Hessler: Arch. f. Ohrenh., XVII., 65, Leipzig, 1881.

"Acute Otitis Media Purulenta Dextra mit Fistelbildung im Warzenforsatz und Ausgang in Tod," H. Hessler: Arch. f. Ohrenh., XVII., 63, Leipzig, 1881.

"Caries of the Temporal Bone from Chronic Suppuration of the Middle Ear," H. C. Houghton: Hahnemann Monthly, Philadelphia, 1881.

"Zur Casuistik des Cholesteatoms des Schläfenbeins; Tod durch Sinus-Thrombose," L. Katz: Berl. klin. Wchnsch., XVII., 167, 1881.

"The Cotton-pellet as an Artificial Drum-head," H. Knapp: Arch. Otol., March, 1881.

"Carie du Rocher; Méningite; Encéphalite," C. Lasègue: Arch. Gén. de Méd., CXLLVII, 218, Paris, 1881.

"Adatok a Dobhártya Tramájához (Wound of Chorda Tympani)," K. Lichtenberg: Gyögyászat, XXI., 217, Budapest, 1881.

"Suppurative Inflammation of the Middle Ear; Otorrhœa or Running from the Ear," W. T. Montgomery: Trans. Illinois Med. Soc., XXX., 162. Chicago, 1880.

"Otite Moyenne Aiguë; Abscès Mastoïdien; Guérison," E. J. Moure: Jour. de Méd. de Bordeaux, Feb. 6, 1881.

"Chronic Purulent Inflammation of the Middle Ear," E. S. Peck: Trans. Vermont Med Soc., 1879.

"On the Value of Operations which involve Incision of the Membrana Tympani," J. Pollak: Med. Press and Circ., London, Feb. 9, 1881.

"Acute Purulent Inflammation of Ear, involving Mastoid Cells, and causing Meningeal Irritation, Treated by Rest in Bed," S. D. Risley: Trans. Amer. Med. Assoc., XXXI., 677, Philadelphia, 1880.

"Functions of the Eustachian Tube," T. F. Rumbold: St. Louis Med. and Surg. Jour., July 20, Sept. 5, 1880.

"Casuistik zur chirurgischen Eröffnung des Wastrenfortsatzes; Zweite Serie von 50 Fällen," H. Schwartze: Archiv. f. Ohrenh., XVI., 260, Leipzig, 1880; XVII., 92, 1881.

"A Case in which the Mastoid was Perforated for Suppuration," S. Snell: London Lancet, May 2, 1881.

"Sordera Grave por Otitis Media Cronica Esclerosa con Anquilosis de los Huesecillos; Gran Mejoria á Beneficio de la Corriente de Induccion," Suñé y Molist: Rev. de Cien. Med., VII., 22, Barcel., 1881.

"De l'Atropine dans le Traitement de l'Inflammation Aiguë de l'Oreille Moyenne," Theobald: Arch. Méd. Belge, Brux., 1880; Gaz. Hebd., Paris, May 11, 1881.

"Rupture of the Membrana Tympani with Diffuse Meningitis; the Result of a Snowball," R. Torrance: Brit. Med. Jour., 1, 191, London, 1881.

"Nasal, Post-nasal, Supra-post-nasal, and Pharyngeal Inflammations, Considered with Reference to Diseases of the Middle Ear; with Remarks upon Treatment," C. S. Turnbull: Med. and Surg. Reporter, XLIV., 197, Philadelphia, 1881.

"Observations on Central Affections of the Acoustic Nerve," V. Urbantschitsch: Arch. f. Ohrenh., XVI., 171.

"Accident in Inflation of the Tympan," Voltolini: Monatsch. f. Ohrenh., May, 1880; Braithwaite, March, 1881.

"Einiger Fälle von Ruptur des Trommelfels," Weil: Memorabilien, XXV., 11, 486, Heilbr.

"Ueber Ohreneiterung und ihre Behandlung," Weil: Memorabilien, I., 94, Heilbr., 1881.

Internal Ear.

"Ménière's Disease: a Case apparently Cured by Quinine and Hydrobromic Acid," E. J. Beall: Texas Med. and Surg. Rec., 1, 27, Galveston, 1881.

"The Action of the Constant Current in Certain Affections of the Internal Ear," Ladreit de Lacharriere: Ann. Mal. de l'Oreille et du Larynx, Paris, Sept., 1881.

"Treatment of Ménière's Disease," Ménière: France Méd., Paris, 1881; Philadelphia Med. Times, April 9, 1881.

"Nerve-atrophy in the First Cochlear Convolution; its Physiology and Pathological Importance," S. Moos and H. Steinbrügge, trans. by I. Furst: Arch. Otol., March, 1881.

"Zur Kenntniss der Morphologie des inneren Ohres bei Wirbelthieren," G. Retzin: Nord. med. Ark., XII., 2, No. 12, 6.

"The Ascending Root of the Acoustic Nerve," C. F. W. Roller: Archiv f. Mik. Anat., XVIII., 4, 403.

Un Tredicesimo Nervo Craniale," G. Sapolini: Ann. Univ. di Med., 255, Milano, 1881.

"Kritisches und Experimentelles zur Physiologie der halbkreisförmigen Canäle," C. Spamer: Med.-clin., Centralbl., XVI., Wien, 1881; Pflüger's Arch., XXI., 479.

MISCELLANEOUS.

"Traumatic Aneurism of the Middle Meningeal Artery," H. N. Spencer: Trans. Am. Otol. Soc., July 21, 1880.

"The Oral Method for Deaf-mutes": Med. and Surg. Reporter, Jan. 15, 1881.

"Speech for the Deaf": Gaillard's Med. Jour., March, 1881.

"Fatal Military Etiquette": Med. and Surg. Reporter, Philadelphia, Feb. 5, 1881.

"Aural Symptoms in Bright's Disease," Berl. k. Wchnschr.; Med. Record, New York, Jan. 22, 1881.

"Statisticher Bericht über die in der Poliklinik für Ohrenkranke zur Halle A.-S. vom 15 Oct., 1879, bis 15 Oct., 1880, untersuchten und behandelten Fälle," Arch. f. Ohrenh., XVII., 40, Leipzig, 1881.

"Laringo-Otologia; Angina Granulosa," R. Ariza: Siglo Méd., XVIII., 70, Madrid, 1881.

"Otoscopia Externa; su Importancia en el Diagnóstico de las Enfermedades Auriculares": Siglo Méd., XXVIII., 187, Madrid, 1881.

"The Tuning-fork in the Diagnosis of Diseases of the Ear," E. C. Baber: London Lancet, April 9, 1881.

"Report on One Hundred Cases of Ear Disease," C. Baker: London Lancet, Aug. 7, 1880.

"Growth of Fungi in Ear-syringes": British Med. Jour., July 24, 1880.

"Contribution à l'Étude des Altérations de l'Oreille dans la Surdi-mutité," Baratoux: Ann. des Mal. de l'Oreille, du Larynx, etc., May, 1881.

"L'Audiphone de Rhodes (de Chicago) a l'Institution Nationale des Sourds-muets de Paris," Baratoux: Ann. des Mal. de l'Oreille, du Larynx, etc., May, 1881.

"Ueber die den acuten Infectionskrankheiten vorkommenden Erkrankungen des Ohres," L. Blau: Deutsche med. Wochenschr., 3, 1881.

"On Deaf-mutism from Compression of the Acoustic Nerve, or Otopiesis," Boucheron: Jour. de Laringol. et d'Otol.

"New Standard of Measurement for Hearing Power, etc.," G. Brown: London Lancet, July 24, 1880.

"Quarterly Report on Ophthalmology and Otology," C. S. Bull: New York Med. Jour., Jan. and April, 1881.

"Bericht über die im Jahre 1879 in meiner Poliklinik f. Ohrenkranke beobachteten Krankheitsfälle," K. Bürkner: Arch. f. Ohrenh., XVI., 1 and 2; Monatsschr. f. Ohrenh., April, 1881.

"Ueber Ohrenkrankheiten bei Eisenbahn-Bediensteten," K. Bürkner: Arch. f. Ohrenh., XVII., 8, Leipzig, 1881.

"Objective Wahrnehmung von Tönen im Ohr in Folge von Willkürlichen-Contraction der Tubenmuskeln," S. M. Burnett: Zeitschr. f. Ohrenh., IX.

"Quarterly Abstract of American Otological Literature," Arch. Otol., March, 1881.

"Cases of Injury to the Ear," P. Cassels: Specialist, London, April 1, and May, 1881.

"Antiseptic Dressing in Suppurative Ear Disease": New York Med. Jour., Jan., 1881.

"A Form of Tinnitus induced by a Rhythmical Contraction of the Tensor Tympani Muscle," Chisholm: Boston Med. and Surg. Jour., May 26, 1881; Trans. Amer. Med. Assoc., 1881.

"Ueber des Gehörorgan der Ganoiden," A. Cison: Arch. f. mik. Anat., XVIII., 486.

"De l'Enseignement de la Parole dans les Institutions des Sourds-muets," Claveau: Paris, 1880; Arch. f. Ohrenh., XVII., 1 and 2. 1881.

"Report of the Aural Department for 1879," W. B. Dalby: St. George's Hosp. Rep., X., 469, 1879, London, 1880.

"Vaso-dilatateurs sympathétique de l'Oreille," Dastre et Morat: Prog. Méd., Paris, Feb. 5, 1881.

"Zur Analyse des Gehörorgan durch Töne in ihrer Bedeutung für dasselbe," Dennest: Berliner klin. Wochenschr., XVIII. and XIX., 1881.

"The Influence of Music on the Circulation of the Blood," J. Dogiel: Archiv. f. Anat. u. Physiol., 4 and 5, 1880.

"Periscope of Otology," Duncanson: Edinburgh Med. Jour., Feb., 1881.

"Optical and Aural Complications in Recurrent Fever," Duschau: Virchow's Archiv; St. Petersb. m. Wchnschr.; Cincinnati Lancet and Clinic, Feb. 26, 1881.

"Pyæmia following a Mastoid Abscess; Treated without Medicine: Recovery," E. T. Ely: Archiv. Otol., March, 1881.

"Contribution to the Knowledge of the Function of the Soft Palate and Pharynx," R. Falkson: Virchow's Archiv, LXXIX., 3.

"The Value of Pain as a Symptom of Ear Disease," G. P. Field: Practitioner, London, March, 1881.

"Tinnitus Aurium," W. D. Flemming: Boston Jour. Chem., Jan, 1881.

"Improved and New Powder Insufflators," E. J. Forster: Boston Med. and Surg. Jour., 229, 1881.

"An Improved Ear-spout," E. J. Forster: Boston Med. and Surg. Jour., 249, 1881.

"Physiologie de l'Audition," Fournié: Bull. de l'Acad. de Méd., Seance of March, 1880.

"Abscess of the Cerebellum and Inflammation of the Lateral Sinuses, with Symptoms Simulating Ear Disease," G. R. Fowler: Proc. Med. Soc. Co. Kings, Aug., 1879.

"German Eye and Ear Infirmary," Med. and Surg. Reporter, Philadelphia, Feb. 5. 1881.

"Otite chez un Tuberculeux; Trépanation de l'Apophyse Mastoïde; Drainage; Guérison," Gillette: Ann. des Mal. de l'Oreille, 249, 1879; Arch. f. Ohrenh., XVII., 1 and 2, 1881.

"Ueber die verschiedenen Formen der Rhinitis und deren Behandlung vermittels der Tamponade," J. Gottstein: Berl. klin. Wochenschr., 4, 1881.

"Sur les Maladies de l'Oreille Compliquant les Exanthèmes Aigus," J. Gottstein: Arch. f. Ohrenh.; Ann. des Mal. de l'Oreille, du Larynx, etc., May, 1881.

"Zur Pathogenese der subjectiven Gehörsempfindungen; Krampf des Musculus Stapedius combinirt mit Blepharospasmus," J. Gottstein: Arch. f. Ohrenh., XVI., 1 and 2; Monatschr. f. Ohrenh., March, 1881.

"Beiträge zu den im Verlauf der acuten Exantheme auftretenden Gehöraffectionen," J. Gottstein: Arch. f. Ohrenh., XVII., Leipzig, 1881.

"Cold as a Cause of Deafness," T. Griffin: Virginia Med. Monthly, Jan., 1881.

"Ueber Verdichtung und Verdünnung der Luft im äusseren Gehörorgan als Heilknittel bei Ohrenkrankheiten," Gruber: Allg. Wien. med. Zeit., I., 1881.

"Bericht über die auf der Klinik des Prof. . . ambulatorisch behandelten Ohrenkranken," Gruber: Aerztl. Ber. d. K. K. Allg. Krankenh. zu Wien., 371 (1879), 1880.

"Zur Lehre von der Knorpel- und Knochen-Neubildung im Gehörorgane," J. Gruber: Wien. med. Presse, XXII., 197, 229, 264, 1881.

"Report of Ear Clinic in the General Hospital, Vienna," J. Gruber: Monatsch. f. Ohrenh., Oct., 1880.

"Ein Demonstrationsspiegel in Verbindung mit dem Ohrtrichter," J. Grünfeld: Monatschr. f. Ohrenh., April, 1881.

"Earache," J. Guerin: Chicago Med. Rev., Jan. 8, 1881.

"On the Question of Ear Symptoms in Bright's Disease," Gurovitsch: Berl. Med. Wchnschr., 42, 1880.

"Summarischer Bericht der K. K. otiatrischen Universitäts-Klinik des Prof. E. Zaufal für das Jahr 1879," J. Habermann: Arch. f. Ohrenh., XVII., 24, Leipzig, 1881; Zeitschr. f. Ohrenh., Feb., 1881.

"Deaf-mute Statistics of the Province of Pomerania and the District of Erfurt," A. Hartmann: Arch. Otol., IX., 4.

"Beitrag zur Anatomie des Schläfenbeins," Hauerwass: Monatsch. f. Ohrenh., 5, 1880; Arch. f. Ohrenh., XVII., 1 and 2, 1881.

"Krankenbericht der Heilanstat für Ohrenkranke in Stuttgart von 1877–1879 und Mittheilungen über die Fortschritte der Ohrenheilkunde in den letzten Jahren," Hedinger: Med. Cor.-Bl. d. Württem. ärztl. Ver., LI., 9, 25, 33, Stuttg., 1881.

"Étude sur les Bourdonnements de l'Oreille," P. Hermet: Union Méd.,

3, s. XXXI., 169, 207, 232, 243, Paris, 1881; Chicago Med. Rev., May 20, 1881.

"Statischer Bericht über die in der Poliklinik für Ohrenkranke zu Halle A.-S. vom Oct. 15, 1879 bis Oct. 15, 1880," H. Hessler: Untersuchten und behandelten Fälle; Arch. f. Ohrenh.. XVII, 1 and 2, 1881.

"Malarial Otitis," F. C. Hotz: Amer. Specialist, II., 33, Philadelphia, 1881.

"Sense of Dizziness in Deaf-mutes," W. James: Harv. Univ. Bull., No. 18.

"Report, in Brief, of the Aural Department, Jefferson Medical College," Med. and Surg. Reporter, Jan. 15, 1881.

"Cure of Septic Infection of the Lungs from Necrosis of the Petrous Bone." Johnson: Med. Times and Gaz., London, May 8, 1880.

"Indicationen und Anwendung des scharfen Löffels bei Geschwülsten der Nasenhöhle und des Nasenrachenraumes," G. Justi: Wien. med. Wochensch., 38, 1880; Arch. f. Ohrenh., XVII., 1 and 2, 1881.

"Zur Geschichte der Worttaubheit," O. Kahler and A. Pick: Zeitsch. f. Heilk., I., 1, 95.

"Zur Casuistik des Schläfenbeines; Tod durch Sinus-Thrombose," L. Katz: Berlin. klin. Wochenschr., XII., 1881.

"Ein weiterer Beitrag zur Casuistik der Schläfenbeinnecrose," Keller: Berl. klin. Wochenschr., Nov. 1, 1880.

"On Heredito-syphilitic Affections of the Ear," H. Knapp: Arch. Otol., IX., 2; Zeitsch. f. Ohrenh., IX., 4, 349.

"On Congenital Fissure of the First Bronchial Fissure," H. Kratz; Inaug. thesis, Bonn, 1880.

"Ueber das häutige Labyrinth der Amphibien," Kuhn: Arch. f. mik. Anat., XVII.

"De l'Utilité des Eaux Minérales dans le Traitement des Maladies de l'Oreille," Ladreit de Lacharriere: Ann. des Mal. de l'Oreille, 125, 1879; Arch. f. Ohrenh., XVII., 1 and 2, 1881.

"La Surdi-mutité," Ladreit de Lacharriere: Union Méd., Paris, May 1, 1881; Lancereaux: Gaz. des Hôp., 88, 93.

"Ear Disease in Railway Employés," F. P. Lewis: Med. Counsellor, Feb., 1881.

"Il Tabacco Causa di Malattie Auricolari e la Pilocarpina nella Cura di esse," G. Longhi: Gazz. Med. Ital.-Lomb., 8. s., III. 42, Milano, 1881.

"Eye and Ear Disease in Relapsing Fevers," Luckhau: Virchow's Archiv, LXXXII.; London Lancet, Jan. 11, 1881; Med. News and Abstr., Feb., 1881; Arch. f. Ohrenh., XVII., 1 and 2, 1881.

"Contributions to the Study of Cerebral Localization; Long-standing Deafness; Atrophy of both Occipital Lobules," J. Luys: Gaz. Méd., 29, 1880.

"The Etiology of Vertigo," P. McBride: Med. Times and Gaz., London, Jan. 22 and 29, 1881; Edin. Med. Jour., Jan., 1881.

"Observations on Ear Diseases," P. McBride: Edin. Med. Jour., April, 1881.

"Causes of Deafness," McIntyre: Phys. and Surg., Feb., 1881.

"Bericht über die vom October, 1878, bis October, 1880, behandelten Ohrenkranken, Marian A.: Arch. f. Ohrenh., XVII., 78, Leipzig, 1881.

"Ear Disease following Scarlet Fever," Merriam: Med. Times and Gaz., London, Oct. 30, 1880; Med. and Surg. Reporter, Philadelphia, Jan. 8, 1881.

"Emploi du Nitrite d'Amyle dans les Maladies de l'Oreille, du Larynx, etc.," F. Michael: Ann. des Mal. de l'Oreille, du Larynx, etc., March, 1881.

"State Institution for the Deaf and Dumb, Michigan:" Phys. and Surg., Feb., 1881.

"Contribution a l'Étude des Surdités d'Origine Nerveuse," Miomandre: Ann. des Mal. de l'Oreille, du Larynx, etc., March, 1881.

"A Rare Case of Stab-wound of the Left Half of the Skull," S. Moos: trans. by Isidor Furst: Arch. Otol., March, 1881.

"Contributions on Mastoid Disease," H. Morris: London Lancet, May 28, 1880.

"Ueber die Schwindelerscheinungen nach Ohrverletzungen," Munk: Monatsber. d. K. Acad., Berlin, 1881.

"Dell' Arrivo della Voce e della Parola al Laberinto a Traverso le Ossa del Cranei e come ciò siasi ottenuto dal Fonifero prima che dall' Audifono dal Dentafono ed Apparechi simili," G. Paladino: Giorn. Internaz. di Scienze Med., 1880.

"Carcinome de l'Oreille Moyenne et du Rocher," Polaillon: Ann. des Mal. de l'Oreille, 254, 1879; Arch. f. Ohrenh., XVII., 1 and 2, 1881.

"A New Powder-blower," A. Politzer: Wiener med. Wchnschr., 47, 1880.

"Combined Self-retaining Nasal and Aural Speculum," D. N. Rankin: Med. Rec., New York, May 19, 1881.

"De l'Otite Diabétique," M. Raynaud: Ann. des Mal. de l'Oreille, du Larynx, etc., May, 1881.

"Some Points in the Anatomy of the Ear," Retzius: Arch. f. Anat.; London Lancet, Jan. 1, 1881; Med. News and Abstr., March, 1881.

"The Organ of Hearing in Vertebrate Animals," Retzius: Nord. med. Ark., Stockholm, XII. 2; Lond. Med. Rec., May 15, 1881.

"Zur Kenntniss des Gehörorgan der Wirbelthiere," Retzius: Arch. f. Anat. u. Physiol., 235, 1880.

"Some Researches with Prof. Hughes' New Instrument for the Measurement of Hearing, the Audiometer," W. B. Richardson: Proc. Royal Soc., London, 65, 1879.

"Contributions to Otology," S. D. Risley: North Amer. Med. Asso., 1880.

"A New Ear-douche," D. B. St. J. Roosa: Archiv. Otol., VIII., 355; Zeitsch. f. Ohrenh., IX., 24, 323; Arch. f. Ohrenh., XVII., 1 and 2, 1881.

"On Earache, its Varieties and Treatment," G. S. Ryerson: Canada Lancet, XIII., 196, Toronto, 1880–81.

"On the So-called Pharyngitis Granulosa," M. Saalfield: Virchow's Archiv, LXII., 1, 147.

"Zur Entwicklungsgeschichte des Knorpeligen Gehörganges bei Säugethieren," W. Salensky: Morph. Jahrbücher, VI., 3, 415.

"Het Desinfecteeren van Oorheelkundige Instrumenteen (naar Urbantschitsch)," J. Schoondermark: Geneesk Courant, XXXV., No. 1, Tiel, 1881.

"Zweite Serie von 50 Fällen chirurgischer Eröffnung des Warzenfortsatzes," H. Schwartze: Arch. f. Ohrenh., XVII., 1 and 2, 1881.

"Stichverletzung des Ohres mit Ausfluss von Liquor Cerebrospinalis; Schweil Hirnreizung's-Symptome durch Hirnhyperämie Heilung," H. Schwartze: Arch. f. Ohrenh., XVII., 117, 1881, Leipzig.

"Epitome of a Paper on the Nature and Relations of The Diseases of the Ear," R. Sinclair: London Lancet, Feb. 12, 1881.

"A Case of Trepanation of the Mastoid Process; Death by Miliary Tuberculosis," H. Steinbrügge, trans. by W. C. Ayres: Arch. Otol., March, 1881; Zeitsch. f. Ohrenh., X., 1, 33; Arch. f. Ohrenh., XVII., 1 and 2, 1881.

"The Skepticism Prevalent Regarding the Efficacy of Aural Therapeutics," Theobald: Southern Med. Rec., Atlanta, Jan. 20, 1881.

"Sulphide of Calcium in Inflammatory and Suppurative Processes about the Ear and Throat," C. A. Todd: Med. Rec., New York, Feb. 12, 1881.

"Verletzung des Ohres in Gerichtsärztlicher Beziehung," Trautmann: Handb. der gerichtl., Med. von Morschka, 1881.

"Ueber die Bedeutung vorhandener oder überstandener Ohrenleiden gegenüber Lebensversicherungs-Gesellschaften," F .Trautmann: Arch. f. Ohrenh., XVII., 1 and 2, 1881, Berlin, 1880.

"Value of the Dentaphone," E. Tribel: Arch. Otol., December, 1880; Med. News and Abstr., April, 1881.

"Examination of the Hearing of Two Hundred and Sixty-seven Children," Weil: Monatsch. f. Ohrenh., December, 1880.

"Zur Lehre von der Schallempfindung," Urbantschitsch: Wien. med. Presse, XV., 1881.

"Eye and Ear Department, St. Mary's Hospital, Philadelphia," A. H. Wilson: Med. and Surg. Reporter, Philadelphia, March, 1881.

"Auditory Vertigo," W. H. Woodyatt: Trans. Amer. Inst. Homœop., 1878, XXXI., Sect. IX, 243, Philadelphia, 1879.

"Desinfectionskapseln in Verbindung mit den üblichen Luftdoucheapparaten," E. Zaufal: Arch. f. Ohrenh., Leipzig, XVII., 1, 1881.

"Aural Hemorrhage in Suicide by Hanging," E. Zillinger: Wien. med. Wchnschr., 35 and 36, 1880.

NOTES.

ALL communications relating to the editorial department, and all pamphlets intended for review, should be addressed to DR. CLARENCE J. BLAKE, *Hotel Berkeley*, Boston, Mass.

Subscriptions to the JOURNAL, applications for exchange, and books intended for review, should be sent to the publishers, WILLIAM WOOD & Co., *No. 27 Great Jones Street, New York.*

THE Seventh Session of the International Medical Congress will be opened in London on Tuesday, August 2, 1881, at the Royal College of Physicians, Pall Mall, where the Executive and Reception Committees will meet the members between the hours of 4 P.M. and 7 P.M. The meetings for business will commence on Wednesday, August 3d, and will end on Tuesday, August 9th.

The officers of Section X—Diseases of the Ear, are: *President:* William B. Dalby, Esq. *Vice-Presidents:* Dr. Cassells, Glasgow; Dr. Fitzgerald, Dublin. *Council:* A. G. Brown, Esq., London; E. Cumberbatch, Esq., London; Dr. Duncanson, Edinburgh; G. P. Field, Esq., London; Prof. McNaughton Jones, M.D., Cork; James Keene, Esq., London; Dr. H. R. Swanzy, Dublin. *Secretaries:* Dr. Urban Pritchard, 3 George street, Hanover sq., W.; Dr. Laidlaw Purves, 6 Stratford place, London, W.

The subjects for discussion, as already announced, are: 1. On the Value of Operations in which the Tympanic Membrane is Incised. 2. On Morbid Growths within the Ear, and their Treatment. 3. On Loss of Hearing where the External and Middle Ears are Healthy.

All communications regarding Section X. should be addressed to one of the secretaries of the section.

THE editors take pleasure in announcing that the Bibliographical Index of this Journal will, in future, be prepared under the supervision of Dr. Francis H. Brown, of Boston, editor of the *Medical Register*, and formerly editor of the *Boston Medical and Surgical Journal.*

In availing themselves of Dr. Brown's skill as a bibliographer, the editors have in view an enlargement of this department of the JOURNAL, and the introduction of cross-references, thereby increasing its value as a record of the special publications which it is intended to include.

THE

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ORIGINAL COMMUNICATIONS.

COMPARATIVE MORPHOLOGY OF THE EAR.

SECOND ARTICLE.

By CHARLES SEDGWICK MINOT,

BOSTON, MASS.

CONCERNING the majority of invertebrates, we have a very imperfect knowledge in respect of their auditory apparatus. The molluscs are the only class the otocysts of which have been sufficiently studied to enable us to give a comparative treatment. It is greatly to be desired that investigations, similar to those of the Brothers Hertwig on medusæ, should be carried out upon the higher radiates and the vermes. The following pages illustrate the extreme necessity of such investigations.

2. THE CTENOPHORÆ.

The Ctenophoræ all have eight meridional rows of cilia. The *Cestum veneris* was formerly erroneously supposed to have four only, a mistake due to the rudimentary condition of four of the rows. Toward the aboral apex of the animal the eight rows unite to form four, which run toward the centre of the apex, each ending in a plate of cilia. Between the four plates is a bundle of

concrements, forming a mulberry-like sphere. This sphere is covered over by a dome, the origin and morphology of which is not understood. The ectoderm around the apex forms an area of modified cells, including four groups of pigmented cells, containing each a refractile body, quite different from the concrements in the centre. Around this area are four *polar plates* of ciliated cells.

This apex has generally been regarded as the nervous and sensory centre of the animal, and the central sphere of concrements as a mass of otoliths. The last-mentioned structures were first noticed by Milne-Edwards,[1] and later by L. Agassiz,[2] who both considered them eye-specks, which they certainly are not. Since then they have been mentioned by many authors, some of whom have added a little, but not much, to our knowledge of them. Recently two extensive memoirs upon the nervous system of Ctenophoræ have appeared. The first, by Eimer,[3] describes a complicated set of ganglion-cells and nerve-fibres scattered through the body, nowhere gathered into a ganglion, and having no special relation to the otoliths. The second, by Chun,[4] who found no nervous system at all, and denies the correctness of Eimer's statements. He advances, however, the very queer opinion that the ciliated bands are the nervous system, solely on the ground that when a beat of the cilia is started at the apex against the sphere of concrements, it runs wave-like centrifugally along the band! Such a view, of course, cannot for a moment be seriously entertained, because a wave-like propagation of the beat is a general characteristic of ciliated surfaces, and certainly is no index of a nervous system. Chun failed to find any nervous elements, or, what is of especial interest to us, any sensory cells in the neighbor-

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[1] Edwards, H. Milne: Observations sur la Structure et Fonctions de quelques Zoophytes, Mollusques et Crustacés des Côtes de la France. Ann. Sci. Nat., XVI. (1841), 193–232 (*Vide* pp. 205–206).

[2] Agassiz, Louis: Contributions to the Natural History of N. A. Acalephæ. Pt. II., Mem. Am. Acad., IV. (1850), 313-374 (*Vide* Pl. V., figs. 9, 10).

[3] Eimer, Th.: Zoologische Studien auf Capri (I. Ueber *Beræ ovatus*, pp. 52–82).

[4] Chun, Carl: Das Nervensystem und die Muskulatur der Rippenquallen. Abh. Lenkberg. Natforsch. Ges., XI. (1878), 181–232, 2 Tafeln.

hood of the concrements. From this review it is evident that we cannot assert that the concrements are part of an auditory apparatus. At most, we can only say that, according to the observations of Kowalewski,[1] confirmed by Chun, the concrements are developed like true otoliths in the interior of cells of the ectoderm, afterward falling out to be added by the action of the surrounding cilia to the sphere. I cannot but think Chun's account of the apical region not entirely accurate. Indeed, the Brothers Hertwig, in their paper[2] on "Actinien," incidentally contradict his views, as does also Hartmann,[3] so that we may safely consider his singular hypothesis in regard to the nervous system and the function of the concrements to have been definitely set aside.

To conclude, we cannot tell whether the Ctenophores have an auditory organ or not.

3. The Echinoderms.

Our knowledge of the organs of hearing of this class is confined to a single observation, of somewhat problematical character, upon *Synapta digitata*, by Baur.[4] He found five pairs of closed vesicles upon the radial nerves, close to the oral calcareous ring. Each vesicle is united with the neighboring nerve by a short pedicle. The vesicles are lined by an epithelium resting upon a fibrous *tunica propria.* They have, at the time when the Synapta has just completed its metamorphosis, one or several bodies in their interior, which are round, quite homogeneous, highly refractile, and constantly trembling, but in the fully grown animal they were not found. Johannes Müller observed them in the young Synapta. As these vesicles contain concrements, they are possibly auditory sacs with otoliths. This possibility is the whole of our knowledge of the organ of hearing in echinoderms.

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[1] Kowalewski, Anton: Entwickelungsgeschichte der Rippenquallen. Mém. Acad. St. Petersb. X., (1866), 4me Mém.

[2] Hertwig, O. and R.: Jena Zeitschr. Natwiss., XIII. 1879.

[3] Hartmann: Einige Verhältnisse in der Organisation von Pleurobrachia pileus. Sitzber. Natforsch. Ges. Berlin, 18 Febr., 1879.

[4] Baur, Albert: Beiträge zur Naturgeschichte der Synapta digitata. Erste Abh., S. 46-47. Nova Acta L—C. Akad. XXI. 1864.

4. The Mollusca.

Since the best researches assign to the rotifera and brachiopoda immediate relationship with the molluscs, it would be proper to describe their otocysts next; but, unfortunately, we can only say that in certain forms of both the classes above-named a vesicle or pair of vesicles have been observed, which a vague surmise has interpreted as otocysts.

In the true mollusca there are normally a pair of otocysts, which arise, and usually permanently remain, near the pedal ganglion, although the auditory nerve has its origin in the brain or supra-œsophageal ganglion. Formerly the otocysts of Lamellibranchs were supposed to be innervated from the pedal ganglion; but Simroth[1] has shown that the nerve descends with the commissure part way to the vesicle, or, in other words, that the nerve appears to arise from the œsophageal ring.

The otocysts were first observed in the Cephalopods by John Hunter;[2] in the Heteropods and Pteropods, by Eydoux et Souleyet,[3] in 1838, followed the next year by independent and more accurate investigations by Krohn;[4] in the Lamellibranchiata, by Siebold,[5] in 1838; in the Gasteropoda, by Siebold,[6] in 1841. Since then a considerable number of authors have contributed to our knowledge of these organs. A list of the more important papers is given on p. 261, and the works themselves are referred to in the following pages by the Roman numerals prefixed to the titles on that list. It is to M. Lacaze-Duthiers that we are indebted for the very acceptable name *otocyst*.

Concerning the very first development of the auditory vesicle,

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[1] Simroth: Zeitschr. f. wiss. Zool., XXV., pp. 269, 270. 1875–76.

[2] Hunter's Works, Vol. IV., p. 294. Reprinted from Phil. Trans., p. 379. 1782.

[3] Eydoux et Souleyet: L'Institut, 1838, No. 255, p. 376 (Transl. Wiegmann's Arch., 1839, II., 215, and Froriep's N. Not., Nro. 175, p. 312).

[4] Krohn: Müller's Arch., 335. 1839.

[5] Von Siebold: Müller's Arch., p. 52. 1838.

[6] Siebold, C. Th. von: Ueber das Gehörorgan der Mollusken. Wiegmann's Arch., I., 148–166, Taf. VI. (This is by far the most important of all the earlier memoirs.)

the observations are not numerous; but in a few species there is a small invagination of the ectoderm on the side of the foot, not far from the pedal ganglion, and immediately behind the primitive kidney (*Urniere*), when that structure is present. For example, in *Fusus* it has been observed by Bobretzky (I., p. 133, Taf. XII., figs. 80, 81); in *Firiloides* by H. Fol (IX., pp. 134, 135, Pl. II., fig. 28, *wi.*); and in *Loligo* by Brooks (III., p. 9, fig. 9, *er.*). The invagination is afterward constricted around the neck, and so soon becomes converted into a closed vesicle. The cells which form the otocyst are thicker and larger than those which remain to form the epidermis. The differentiation of our organs begins very early, about the same time as the eyes, and before the histological differentiation of the nervous system. Gegenbaur, however, states that the ear first appears in Limax as a solid group of cells (XII., p. 385), which afterward becomes hollowed out. There can hardly be much doubt that this opinion is based upon an imperfect observation. Application of the general principles of embryological specializations justifies the provisional assumption that the otocysts are developed in all molluscs as a pair of ectodermal invaginations. A layer of mesoderm early appears around the young otocyst, and forms ultimately the *tunica propria*, upon which the epithelium rests. The otoliths arise later in the epithelium (Fol), and gradually enlarge. They are, therefore, cellular concrements. So long as the first appearance of these deposits were unknown, the opinion prevailed that they were formed by precipitation in the fluid of the vesicle. This view was always without much plausibility, because all morphological elements are, so far as known, always formed by the direct action of cells, the nearest approach to an exception being the deposit of substances in cell-walls, as, for instance, in the formation of shells. Shortly after the otoliths are formed, cilia appear in the interior of the auditive vesicle, and impart (?) a constant trembling motion to the ear-stones. Apparently the vesicle is filled with fluid from the very first; but thereabout is much uncertainty.

The primitive form of the vesicle is approximately spherical, since this is its shape in all young molluscs. Its primitive size is so small that its epithelial wall consists of only a few, or at most a small number of shells, about as high as they are broad.

There is a single small spheroidal otolith, which in *one type* of ear remains single, but in that case enlarges greatly—sometimes enormously, while its shape remains nearly the same. In the second type, the otolith remains small, growing a little and generally changing its form, and a considerable number of otoliths are added, duplicating the first many times. The Lamellibranchs, *Dentalium*, and most Gasteropods have an ear preserving tolerably these original types. In the Heteropods we find a very great enlargement, and other specializations of a histological character, of which later. Finally, in the Cephalopods, in addition to the large size, occur modifications of shape (Owsjannikow und Kowalewski, XX., pp. 17, 18).

In certain Gasteropods (cf. Lacaze-Duthiers, XV.) there is a tubular prolongation of the vesicle embraced by the nerve. Boll (II., 75) from his observations thinks it possible that this canal may be present in all Gasteropoda. In the dibranchiate Cephalopods there is a similar canal, which was first observed by Kölliker, and has been named the *Ductus Kollikeri* by Grenacher; the duct is the remnant of the tube, which, for a time, connects the vesicle with the orifice of the primitive invagination. Its embryological significance was first indicated by Ray Lankester, and definitely proven by Grenacher. In the Octopoda the otocyst does not otherwise vary greatly from the simple spheroidal form; but in the Decapoda, Owsjannikow and Kowalewski (XX., 17, 18), basing their observations upon *Sepia officinalis*, found several projections[1] from the wall into the interior of the vesicle, and large enough to be visible to the naked eye; also several recesses. Neither the protuberances nor cavities bear the sensory cells, and their functional value cannot be guessed. In the tetrabranchiate cephalopods (*Nautilus*), on the other hand, in agreement with the lower rank of the animal, the ear has a simpler form, being merely a rounded sac, lying near the eye.

The primitive position is at the side of the foot; but in many species the otocysts, after they have been formed, change their places.

[1] O. and K. have given the glaringly inappropriate name of *ampullæ* (! !) to these projections.

Very frequently they move toward the median ventral line, and may even travel so far as to meet on the median line right below the pedal ganglion. This occurs in the Cephalopoda, in which the two otocysts are separated only by a thin partition. Again, in many Gasteropods, they pass forward to a position behind the eyes (certain Heteropoda and Apneusta), or even come to lie against the supra-œsophageal ganglion itself (*e.g.*, Doris, Æolis, Tergipes, etc.). Morphologically, the original proximity to the pedal ganglion has a peculiar and very profound significance, first recognized by Hatschek.

Passing now to the consideration of the minute anatomy, we begin with the part derived from the middle germ layer, that is to say, the *tunica propria.*

The outer layer of the vesicular wall is composed of cellular and fibrous elements, and is pierced by the auditory nerve, and, at least, sometimes is thicker opposite to than in the neighborhood of the nervous passage, but is always a thin layer. The cells have been recognized chiefly by their elongated nuclei, but in a few cases they have been seen as typical amœboid connective corpuscles. Outside follows the ordinary connective tissue of molluscs (*zellig-blasiges Gewebe*), except that the calcareous corpuscles are lacking around the vesicle. In the Naiadæ there is a third envelope of a peculiar erectile tissue (Simroth, XXVII., 271), which separates the true *propria* from the surrounding unmodified tissue.

In the *Cephalopoda* the *propria* is very thin, being encased by a capsule formed in the head-cartilage. The cartilage presents the appearance characteristic in this class of animals—the cells having ramified bodies lying in clusters, and possessing one or several, often three nuclei. The proper tunic itself consists of merely a few fibres and remains of cells (Boll, II., 84), and contains an abundant, but fine net of capillaries. At one point it is thickened, forming a prominence which is termed the *Bindegewebswulst*, and consists principally of closely crowded, star-shaped, anastomosing connective corpuscles. The *Wulst* is covered by a flat epithelium like that of the otocyst-wall.

There can be little question that the primitive form of the

epithelium of the otocyst is a layer of large cubical cells, not very numerous, all essentially alike, and bearing very short cilia, which are frequently described as vibratile; to their action the majority of writers attribute the constant oscillation of the otoliths. That the cilia are vibratile I consider more than doubtful, and for the joggling of the small otoliths I prefer to adopt the explanation advanced by von Siebold, and which has since been generally overlooked. Siebold (XXVI., 155, 156) wrote: "Noch besser glaube ich das eigenthümliche Oscilliren der Gehörsteinchen mit folgendem Phänomene vergleichen zu können. Bringt man ein Häufchen groben Sand mit einem Tropfen-Wasser auf den einen Ast einer Stimmgabel und erschüttert man die letztere durch einen mässigen Schlag, so wird man die in dem Wassertropfen zerstreuten Sandkörner sich sogleich im Mittelpunkte des Tropfens sich vereinigen sehen, die einzelnen Körner wühlen und drängen sich unter oscillirender Bewegungen nach dem Centrum des Sandhäufchens, wobei die äusseren Körner von Haufen abgestossen und schnell wieder angezogen werden."

Accordingly, we may safely assume that the otolithic movements are the direct effects of sound-waves.

To return to the lining epithelium, the primitive form is preserved in many Lamellibranchs and in some Gasteropods and Pteropods (Fig. 7).

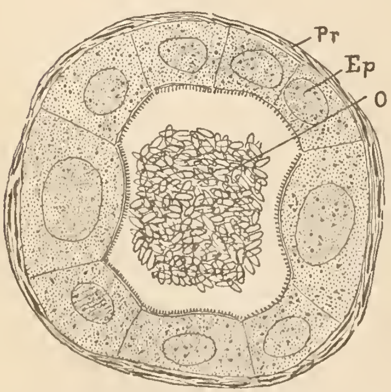

FIG. 7.—Otocyst of Succinea amphibia, in optical section, after Boll: *Pr*, tunica proprla; *Ep*, lining epithelium; *O*, otoliths.

Thus, in *Succinea* and several *Opisthobranchs* the cells are colossal, with a large oval nucleus in their centre. A peculiar modification appears in *Cyclas* (Simroth, XXVII., 274, 275), but Simroth's description and figures do not go very well together, nor do his figures agree with one another. There are large cells with a comparatively small nucleus and a bunch of long bristles; these cells are, perhaps, separated by intervening small cells; in this case there

is a resemblance with Heteropods (*vide infra*). The first modification of the epithelium we have to notice is that the cells are smaller, more numerous, and distinctly cubical or cylindrical in shape (Fig. 8). In the *Naiadæ*, *Neritina* and other Gasteropods, in *Dentalium* and in *Nautilus*, there is such an epithelium, presenting, so far as known, no differentiation of a *macula acustica*. We cannot even guess at the actual succession of these changes either in the phylogenetic or individual development, since each modification in the size and form of the cells reoccurs as we skip from one class to another, and embryologists have failed to note the succession of the alterations in the otic epithelium.

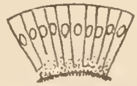

FIG. 8.—Auditory epithelium from the otocyst of Neritina fluiratilis, after Boll.

On the other hand, there is an unmistakable advance in the specialization of the ear in Heteropods and the dibranchiate Cephalopods.[1] In the former class the otocysts present a series of striking peculiarities, which have been very accurately elucidated, as naturalists have always shown a predilection for the study of these organs. The acoustic sac is spherical and encloses a large spherical otolith, Fig. 10, 1; the nerve enters at one side, its fibres radiating over the otocyst; opposite to the nerve is the large *macula acustica*, formed by a thick sensory epithelium; the remaining and larger part of the vesicle is lined by a low epithelium, consisting of two very different kinds of cells: one small and numerous and indifferent, the other larger, bulging above the small cells and bearing a bundle of long bristles. A surface view of this part is shown in Fig. 9. The bristle-cells are star-shaped, giving off five or six tapering processes that end without entering into connection with other parts, and receiving each a nerve-fibre (Fig. 9, A).

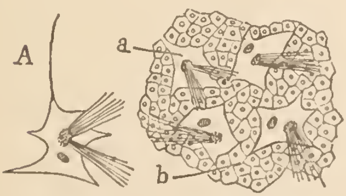

FIG. 9.—Epithelium of the otocyst of Pterotrachea mutica, after Boll: *A* and *a*, bristle-cells; *b*, indifferent cells.

[1] I think it quite possible that closer observation will reveal a *macula acustica* in *Nautilus*, the otocysts of which are very imperfectly known. (Cf. MacDonald, Phil. Trans., 1855, p. 277.)

The protoplasm of these cells is pale, finely granular, and encloses an oval nucleus with several nucleoli. Near the nucleus there is always found a round, dark, granular mass, the *bolster*, from which arises the bundle of bristles. In *Carinaria* and *Pterotrachea coronata* there are some twenty-four, in *Pterotrachea mutica* about fifteen, of these bristle-bearing cells. When at rest the bundles of stiff hairs or bristles recline against the wall of the vesicle, but in the living animals the bundles are suddenly erected after a few seconds' repose; they then stand straight out from the wall, pressing against the otolith. The hairs remain stiff and straight all the time, and must be moved by the action of the cell-body in which they are rooted. The erection lasts two or three seconds, and then the reclining attitude is suddenly resumed (Boll, II., 78, 79). The function of these hairs, and the meaning of their strange jerkings is undetermined, although Boll surmises that the bristle-cells are sensory. It seems equally possible that the nerve of the cell is motor. The *macula acustica* centres around the distal pole, and occupies about one-sixth of the vesicle. It is composed of a central cell, four supporting-cells, and several concentric rows of hearing-cells (Fig. 10 : 1). The hearing-cells have spaces between them, but no one has yet discovered how these spaces are occupied. I anticipate that they will be found to be filled by indifferent cylinder-cells separating the auditory cells, as in Octopus and Sepia (see below). The central cell is 30μ high and about the same in diameter; it produces a slight bulging of the outer membrane; on the central

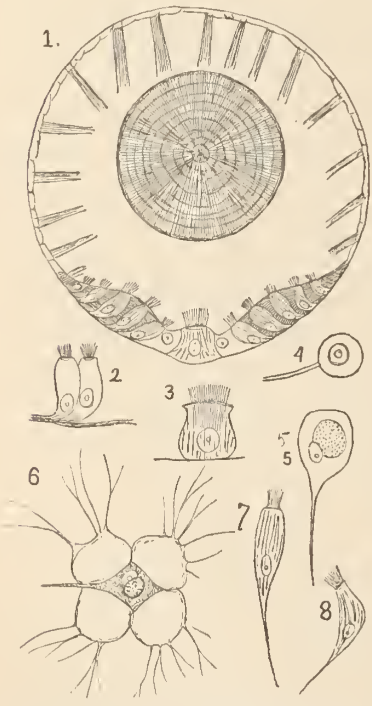

FIG. 10.—Otocyst of Pterotrachea, after Claus; 1, otocyst of P. fredericii, magnified; 2, 7, 8, hearing-cells of the macula; 3, 5, central cell of macula; 6, central cell and four supporting-cells of the macula.

area of its free or inner surface it carries a large number of *Hörhaaren;* viewed from above, the nucleus is seen to lie excentrically, Fig. 10: 5 and 6; the base is prolonged into a tapering process continuous with a nervous fibrilla, Fig. 10: 5. The characters of this cell induce me to regard it as homologous with the bristle-cells outside the *macula.* The central cell is surrounded by four supporting-cells, of the same diameter but less height than itself; they are fastened to the outer membrane by branching processes. Claus affirms that these cells carry no hairs. Ranke says that they do. The four supporting-cells are surrounded by concentric rows of *Hörzellen* (four rows in Pterotrachea fredericii, six or seven in P. coronata and Carinaria). The cells themselves, Fig. 10: 2, 7, 8, are "cylinder cells," swollen in the middle; their bases end each in a tapering process, which bends radially away from the central cell and becomes continuous with a nerve-fibrilla; from the circular central areas of their free surfaces arise the auditory hairs, passing out from the cells through pores of the cuticula; the oval nucleus is placed near the base of the cell; toward the edge of the *macula* the cells gradually grow lower and smaller.

In the dibranchiate Cephalopods the epithelium is reduced to a simple, flat layer, except over the oval *macula acustica* on the upper wall, and over the *crista acustica,* which is a ridge following a curving line on the lower wall. Whether the *crista* is merely the extension of the simple *macula,* or a distinct new structure, is at present impossible to decide, although Grenacher's embryological observations are, if anything, favorable to the latter view. The *ductus Köllikeri* is lined by a ciliated epithelium, the cilia beating toward the main cavity.

Fig. 11.—Surface view of the epithelium from near the border of the *macula acustica* of Octopus macropus, after Boll: *h*, auditory cell: *s*, indifferent cell; *H*, isolated auditory cell.

The *macula acustica* of Octopus (*Gehörplatte* or *Gehörscheibe*) is covered by high cylinder-cells of two kinds, one having a diameter several times greater than the other (Fig. 11). The small cells are most numerous near the edge of the disc, the centre being composed almost entirely of large cells; these last are stated by Owsjannikow and Kowalewski to be connected each with a nerve-fibrilla, and we

must, therefore, consider them the acoustic cells. When isolated (Fig. 11, *H*), they are seen to have a cylindrical form, with very granular protoplasm, an oval nucleus in their lower part, a fine, cuticular border on their free surfaces, on which rise a large number of very short hairs; in their upper ends are several curious longitudinal streaks in the protoplasm. These streaks are *not* the inward prolongations of the cilia, being much too coarse and also less numerous. The small cells appear to be indifferent, acting only as supports. The *macula* of *Sepia officinalis* contains large cylinder-cells like those of Octopus, but the smaller cells have not yet been observed.

The *crista acustica* is a ridge of sensory cells, supported on either side by several rows of cells, which gradually pass from cylinder-cells into the flat epithelium of the otocyst. In *Octopus* the auditory cells form two rows (Fig. 12), each cell being about as thick as broad; in *Sepia* there is but a single row, and the width or the diameter across the row of each cell is two or three times as great as its breadth, as if the mutual pressure of the cells had flattened them. In general appearance the sensory *crista*-cells resemble the large cells of the *macula* (Fig. 11, *h* and *H*). In Octopus they can be distinctly seen to receive laterally each a nerve-fibrilla (Ows. and K., XX., 31).

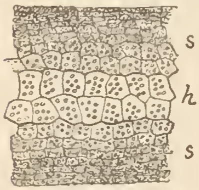

FIG. 12.—Surface view of a small part of the *crista acustica* of Octopus macropus, after Boll: *h*, hearing-cells; *s*, supporting-cells.

The otoliths appear either as numerous small bodies or as a single large one, which, of course, suggests that the large otolith is developed by the agglomeration of several small ones. In fact, certain intermediate stages actually occur, and in the large otoliths of Cephalopods traces of the corresponding small elements have been described.

The small otoliths are found, so far as investigation has yet gone, in most Gasteropods, except Paludina impura, Litorina, etc., in all Pteropods, and in Dentalium and Nautilus. They vary greatly in size, number, and shape. When first formed they are round, but as they enlarge their outline changes. Their most usual final shape is that of a prolate-spheroid, or, in homelier phrase, whetstone-shaped (Fig. 7). Such stones are found in many Gasteropods, in

the Pteropods, and Scaphopods. On the other hand, they may have a distinctly crystalline form, which is stated to agree with that of arragonite. Minute descriptions of the modifications in several species are given by Adolf Schmidt (XXIII.). The fact that of two species of one genus—Paludina—one has multiple, the other a single large otolith, is a forcible argument in favor of the agglomeration of the little to form the large ear-stones.

The large otoliths are found in all Lamellibranchs, in a few Gasteropods, and in all Heteropods and dibranchiate Cephalopods. Except in the Dibranchiata they do not vary greatly from a sphere in shape. They often have a kernel of different appearance from the rest of the stone. They exhibit a radial striation, and often also a system of concentric lines. They sometimes show a cross-shaped figure in their middle. Simroth attributes this appearance to the disposition of the organic matter in the centre. These round otoliths keep up a steady, but not rapid revolution around their own axes. The motive power has yet to be discovered. Those of the dibranchiate Cephalopods are attached by unknown means to the *macula acustica*, and do not revolve. Their shape is also modified; they are pyramidal, with their bases bulging and rounded; the base rests upon the *macula*. In the Decapoda the pyramid is not simple, but has a complicated form, well shown when it is viewed looking down upon it as it rests upon the *macula* (Fig. 13). The otolith is, in proportion to the size of the vesicle, much smaller than in the other mollusca; for example: in Octopus it is only large enough to cover the *macula acustica*.

FIG. 13.—Otolith of Sepia officinalis, after Owsjannikow and Kowalewski.

The otocysts are always filled with fluid, which has never yet been investigated as to its nature.

BIBLIOGRAPHICAL LIST OF THE PRINCIPAL PUBLICATIONS ON THE OTOCYSTS OF MOLLUSCS.

I. Bobretzky, N.: Studien ueber die Embryonale Entwickelung der Gastropoden. (Ohr, 133 and 141). *Arch. mikros. Anat.*, XIII. (1876), 95–169.

II. Boll, Franz: Beiträge zur vergleichenden Histiologie des Molluskentypus. (Gehörorgan, 73–90.) *Arch. mikros. Anat.* (Suppl. 1869), pp. 111. 4 Tafn. (The best research in regard to the histology.)

III. Brooks, W. K.: The Development of the Squid, Loligo pealii (Lesueur). *Anniv. Mem., Boston S. N. H.* (1880), pp. 22, 3 Pls.

IV. Claparède, Édouard: Anatomie und Entwickelungsgeschichte der Neritina fluviatilis. *Müller's Arch.* (1857), 109.

V. ——: Beitrag zur Anatomie des Cyclostoma elegans. *Müller's Arch.* 1858.

VI. Claus, Carl: Das Gehörorgan der Heteropoden. *Arch. mikros. Anat.*, XII. (1876), 102-118. Taf. X.

VII. ——: Ueber den acustischen Apparat im Gehörorgan der Heteropoden. *Arch. mikros. Anat.*, XV. (1878), 341-348. Taf. XXI.

VIII. Fol, Hermann: Sur le Développement des Ptéropodes. (Organes des Sens, 87-91, and 147-151.) *Arch. Zool. Exp't.*, IV. (1875), 1-214. Pl. I.-X.

IX. ——: Sur le Développement Larvaire et Embryonaire des Hétéropodes. (Otocystes, pp. 134. 135.) *Arch. Zool. Exp't.*, V. (1876), 105-158. Pl. I.-IV.

X. Frey, Heinrich: Ueber die Entwickelung der Gehörwerkzeuge der Mollusken. *Arch. f. Naturges.*, I. (1845), 217-222. Taf. IX., figs. 1-10.

XI. Grenacher. H.: Zur Entwickelungsgeschichte der Cephalopoden. (Ohr, pp. 429, 432. 437-441.) *Zeit. wiss. Zool.*, XXIV. (1874), 419-498. Taf. XXXIX.-XLII.

XII. Gegenbaur, Carl: Beiträge zur Entwickelungsgeschichte der Landgastropoden. (Ohr, pp. 382 and 402.) *Zeit. wiss. Zool.*, III. (1851), 371-411. Taf. X.-XII.

XIII. Jhering, H.: Die Gehörwerkzeuge der Mollusken in ihrer Bedeutung für das natürliche System derselben. 8vo. Erlangen, 1876. Pp. 33.
(This paper I know only from Hofmann and Schwalbe's Jahresbericht.)

XIV. Lacaze-Duthiers, Henri: Histoire de l'Organization et du Développement du Dentale. 2me Partie. (Otocystes, 371-374.) *Am. Sci. Nat. Zool.*, VI. (1856), 319-384. Pl. XI.-XIII.

XV. ——: Otocystes, ou Capsules Auditives des Mollusques (Gastéropodes). *Arch. Zool. Ept.*, I. (1872), 97-168. Pl. II.-VI.

XVI. Leydig, Franz: Anatomische Bemerkungen ueber Carinaria, Firola und Amphicora. *Zeit. wiss. Zool.*, III. (1851), 325-332.

XVII. ——: Ueber Cyclas cornea, Lam. (Gehörwerkzeuge, pp. 51-52.) *Müller's Arch.* (1855), 47-66. Taf. V., figs. 8-18.

XVIII. ——: Zur Anatomie und Physiologie der Lungenschnecken. (Das Ohr, pp. 58-61.) *Arch. f. mikros. Anat.* I. (1865), 43-67.

XIX. ——: Ueber das Gehörorgan der Gasteropoden. *Arch. f. mikros. Anat.*, VII. (1871), 202-219. Taf. XIX.

XX. Owsjannikow, Ph., und Kowalewski, A.: Ueber das Centralnervensystem und das Gehörorgan der Cephalopoden. (Ohr, 16-20, 29-32.) *Mém. Acad. St. Petersburg*, XI. (1867), No. 3, pp. 36. Taf. I.-V.

XXI. Rabl, Carl: Ueber die Entwickelung der Tellerschnecke. (Gehörbläschen, pp. 622, 623.) *Morph. Jahrb.*, V. (1879), 562-660. Taf. XXXII.-XXXVIII.

XXII. Ranke, Johannes: Der Gehörvorgang und das Gehörorgan bei Pterotrachea. *Zeit. wiss. Zool.*, XXV. (Suppl. 1875), 77-102. Taf. V.

XXIII. Ranke, Johannes: Das acustische Organ im Ohr der Pterotrachea. (Erwiederung an Claus.) *Arch. mikros. Anat.*, XII. (1876), 565–569.

XXIV. Schmidt, Adolf: Ueber das Gehörorgan der Mollusken. *Wiegmann's Arch. Natges.*, VIII. (1856), 389–407. Taf. II.–IV.

XXV. Siebold, C. T. von: Ueber ein räthselhaftes Organ einiger Bivalven. *Müller's Arch.* (1838), 49–54.

XXVI. ——— : Ueber das Gehörorgan der Mollusken. *Wiegmann's Arch.* (1841) Bd. I., 148–166. Taf. VI.

XXVII. Simroth, Heinrich: Ueber die Sinneswerkzeuge unserer einheimischen Mollusken. (Das Ohr, 269–383). *Zeit. wiss. Zool.*, XXVI. (1875–76), 227–349. Taf. XV.–XXI.

REMOVAL OF FOREIGN BODIES BY DISPLACEMENT FORWARD OF THE AURICLE AND CARTILAGINOUS MEATUS.[1]

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H. L. B——, aged forty years, on May 11, 1881, with suicidal intent, placed the muzzle of a small revolver directly in the right auditory meatus, and fired two shots into that passage. The immediate effect was absolutely negative, and on May 14th he was brought to the City Hospital, complaining only of dull, diffuse headache over the right side, with soreness of the ear and right side of the face. Examination showed the whole right side of the face considerably swollen, and there was inability to draw up the right angle of the mouth, close the right eye, or move the right ala of the nose; there was no discoloration about the ear, and the visible skin of the meatus was unbroken. The pulse, temperature, and respiration were normal, and there was no dizziness. The appetite was good, and there was no apparent affection of the intellect or speech. The movements of the jaw were perfect. Examination with the speculum and reflected light showed the deeper meatus completely filled with black masses of half-burnt powder, and, with a probe, loose foreign bodies could be felt deep in. On attempting removal of the black masses, they were found to be mixed with shreds of fibrous tissue, still adherent. There was a moderate amount of discolored serum discharging from the ear.

May 17th.—Under ether, a semicircular incision was made above and behind the auricle, through the periosteum, and the periosteum with the auricle and cartilaginous meatus carried forward till the edge of the osseous meatus was reached; the insertion of the cartilaginous to the osseous passage was then cut through in its upper and posterior part. The little finger inserted immediately felt a loose foreign body, which was readily seized with forceps, and, being withdrawn, proved to be an irregular bit of lead. After syringing and digging out masses of powder, another loose foreign body was felt, and proved to be the anterior osseous wall of the meatus, nearly rectangular in shape, and about six millimetres broad by ten millimetres long. No more loose bodies could be felt; but, with a porcelain-tipped probe, lead-marks were obtained

[1] Read before the American Otological Society, July 26, 1881.

deep in, and, with considerable difficulty, a second mass of lead, which was firmly impacted, was loosened and withdrawn. The meatus was now so clear that inspection was possible, and it was seen that the whole deepest meatus was filled with a dark mass, firmly fixed, but of what character was uncertain till the porcelain probe was used and lead-marks again obtained. This was seized with strong forceps, gradually loosened, and removed, making a third mass of lead. All of the tissues within the meatus were black, and none of the land-marks could be discovered, but inspection and Nélaton's probe failed to find any further foreign body. The auricle was replaced, the incision united by sutures, and a carbolic dressing applied. The same dressing was continued, and the meatus was syringed three times a day with a carbolic solution.

May 19th.—The patient was doing well, pulse and temperature normal, and appetite good. Moderate sero-purulent discharge from meatus. The headache he reported as much better.

May 20th.—Doing well.

May 21st.—Thick purulent discharge from ear. No other change, except that he insists on sitting up, and is reported by the nurse to "act queerly." P.M.—Refuses food, and is very sullen, not answering questions.

May 22d.—Refuses food and medicine; requires to be held while wound is dressed; thinks he is at sea, and that the floor is sinking. Pulse, 120; temperature, 101.5; brandy, beef, and milk. P.M.—Violently delirious; pulse, 140 and weak; respiration shallow, and died at 1.40 A.M., on May 23d.

Autopsy by Dr. E. G. Cutler, pathologist to the hospital, on May 24th, thirty-eight hours after death.—The wound in the temporal region presented a greenish, discolored appearance. There was nothing remarkable in the soft parts of the head away from the wound. The dura mater showed a slight greenish discoloration over the petrous bone, found to be due to serum beneath the pia. Pia slightly injected. Over the convexities near the longitudinal sinus were a number of old thickenings of the pia, usually of small area, and none larger than the head of a pencil. Over the petrous bone, for an extent of half an inch in diameter, just above the roof of the tympanum, the dura, pia, and brain-substance were firmly adherent, and could not be separated from the bone; just above this, entering the brain and passing upward for half an inch, was a small sinus, evidently the track of a piece of one bullet. Small fragments of bone were imbedded in the dura at this point; the pia was much injected in the vicinity of this wound, and blood had settled in the pia and gravitated downward into the posterior fossa

of the skull. The wound and adjacent tissues contained much pus, as did also the glenoid cavity. The brain-substance was injected, and showed a small amount of senile atrophy. Pachymeningitis existed over the right convexity. Other organs were not examined.

The right temporal bone was removed and examined by me. The whole anterior wall of the osseous meatus down to the tympanic ring was lacking. The tissues in front of the ear, around the glenoid fossa, were gangrenous. The roof of the tympanum was perforated by an opening eight millimetres long and four millimetres broad, this opening being covered by the inflamed and adherent dura, and corresponding with the bullet-track in the brain. The bone within the tympanum was entirely denuded; no trace of any of the ossicles could be found, and the lower edge of the fenestra ovalis was broken away, making a large opening into the vestibule, and the promontory around this opening was black. No trace of any lead was found within the bone.

Unfortunately the bit of brain containing the bullet-track was lost, but there was no doubt that the brain was perforated by a bit of the bullet which passed through the tympanic roof.

The pieces of lead removed by operation weighed respectively $6\frac{3}{4}$, $19\frac{3}{4}$ and $21\frac{3}{4}$ grains, in all $48\frac{1}{4}$ grains, while two bullets of the size used would weigh 60 grains, leaving $11\frac{3}{4}$ grains, which in all probability entered the brain.

Remarks.—On first examining the case I found that the entrance of the meatus was unusually small. The largest Gruber's speculum which could be inserted measured only five millimetres in its longest diameter, and this fact, with the certainty that the bullets, if found, would be very much flattened, convinced me that removal through the natural meatus would be impossible, even if I was able to get hold of the foreign bodies. I therefore decided to avoid the natural obstructions by entering the meatus behind them, thus getting nearer the seat of operation, and making certain of an opening for extraction at least as large as the osseous meatus, which the external cartilaginous orifice was not. The result proved the correctness of the theory, for only the first and smallest bit of lead

could by any possibility have passed through the external orifice—the measurements of the pieces, which were all of irregular shape, being as follows: No. 1, 5 × 11 × 2 mm.; No. 2, 10 × 13 × 2 mm.; No. 3, 6 × 11 × 5 mm.; while the bone removed measured 10 × 5 × 7 mm.

I was extremely gratified by the freedom afforded for the use of instruments after displacement of the cartilaginous meatus. There was none of the loss in width of grip in forceps, as must always occur when they are passed deeply into a small passage, and in this particular case the loss of the anterior wall of the meatus made it possible to insert the end of the little finger even into the tympanum, thus giving a most valuable guide during the operation.

The chief point of interest was the method of operating, which still seems to me the best that could have been adopted in this case; and if it had not been for the glancing upward of a portion of one bullet through the roof of the tympanum into the brain—a condition which it was impossible to diagnosticate beforehand, either from the symptoms or from any examination—there seemed no reason why recovery should not have occurred with the loss of the hearing in that ear, as the only other injury, aside from that of the soft tissues of the tympanum, was the free opening into the vestibule.

The operation of displacement of the auricle forward for removal of foreign bodies is by no means new in theory. The whole subject is thoroughly discussed by von Troeltsch in the seventh edition of his "Lehrbuch" (1881). The suggestion of the operation is found in Paulus Ægineta (660), and in recent times has been recommended by Hyrtl. Von Troeltsch approves of it where operative interference is implicative and other methods of removal are impossible, but suggests that in children the auricle and cartilaginous meatus be separated from the osseous meatus by a simple incision above the meatus along the squamous bone, and in adults that the osseous meatus be reached by an incision along the lower wall of the cartilaginous canal. Neither of these methods seem to me adapted for giving a thoroughly free and large opening for extraction of expanded bodies like those in this case, and both seem open to the objection of insufficient drainage after the operation, if

such becomes necessary, while the latter method must almost certainly wound the parotid gland and add another element of risk. Von Troeltsch narrates four cases where displacement of the auricle forward was performed—one by Langenbeck, and three by Schwartze; all were successful and recovered; one healed *per primam intentionem*, and the others by granulation.

In the removal of foreign bodies from the ear by other instruments than the syringe—and a certain number imperatively demand such instrumental interference—I have always felt that there were but two universally applicable rules: to see what one was doing, and to be familiar with the minute anatomy. Any one of the great number of methods and instruments which have been used by different operators with success may at some time be adapted to an unusual case, and I am the more surprised to see that so distinguished a surgeon as Prof. Gross writes: "The idea of separating the auditory canal from the squamous process of the temporal bone, with a view of obtaining access to the extraneous substance, as suggested by von Troeltsch, is so absurd that it ought to be ranked among the exploded notions of the barbarous ages." So sure as the author lives, will he some time be obliged to adopt the operation which he so unreasonably condemns—or let his patient die. The "utter futility" of the operation for getting at the foreign body, to quote from a recent writer in the American Journal of Otology, January, 1881, is well demonstrated, not only by the success in the case I have given, but in the four quoted from von Troeltsch.

In examining ears, I have often remarked that in some persons the external portion of the cartilaginous canal was the smallest part of the whole passage, and that just within this construction the passage enlarged very much, especially in its posterior and upper walls. In a reply to the author just above quoted, at the Boston Society for Medical Observation, where the paper was originally read about a year ago, I called attention to this not uncommon anatomical fact, and attempted to show that the suggestion of such an operation was not "absurd," but based on good anatomical grounds, and also expressed the belief that in very exceptional cases some such operation would be necessary.

MALIGNANT GROWTH (ROUND-CELLED SARCOMA) IN THE NASO-PHARYNX, WITH EARLY AURAL SYMPTOMS.

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DR. BURNETT'S REMARKS.

On February 26, 1881, Dr. X——, forty-five years of age, a practitioner of medicine in Philadelphia, consulted me respecting an increasing dulness of hearing in both ears, but chiefly in the left, with autophony, and an altered objective pitch in his voice.

His statements were, briefly, that in 1878 he had suffered from sciatica, and had taken Turkish baths freely for a cure; that he had then experienced what he considered a nasal catarrh, and some hardness of hearing in the left ear, without tinnitus aurium, but with more or less catarrhal resonance in his voice, with autophony. All of these symptoms increased latterly, as he supposed, in consequence of great exposure in his day and night work during the past rigorous winter, and at last he found he could not auscult with either ear. At the same time there was a sensation of moving fluid in his ears when he blew his nose.

Examination of the hearing revealed that the watch was heard, left, $\frac{0}{60}$ in.; right, $\frac{3}{60}$ in. The tuning-fork on the vertex was heard better in the left ear. The voice was heard much better than the watch-sounds. The Eustachian tubes were inflatable by Valsalva's method; the pharynx and anterior nares only very slightly congested. The left membrana tympani was greatly retracted, and thrown into radiate folds; behind it bubbles were seen distinctly. The right membrane was less retracted, without radiate folds, but bubbles were also seen behind it. Both membranes were therefore punctured, and the tympana evacuated, by Valsalva's method of inflation, of several drops of yellowish, transpar-

ent fluid. Both the objective and subjective alteration in the vocal resonance disappeared instantly, and the hearing rose to the normal condition in the right ear, and to nearly a normal point in the left. This relief was maintained until March 8th, nearly two weeks when the right ear began to grow dull again, and the vocal resonance to return, both apparently caused by a filling up of the tympana, with fluid, as before. Bubbles were seen again, and paracentesis of the right membrane let out a larger quantity of yellowish, muco-purulent matter, with the same relief as before. The patient was using at this time a weak solution of sulphate of zinc, 1 gr. to f. ℥ j.—five drops, warmed, in each nostril once daily.

On March 22d the right membrane had to be again punctured for the relief of the previous symptoms; but the left ear showed no bubbles behind the membrane, and hence did not seem to require puncturing. Not so, however, on April 8th, when both membranes required puncturing, which was followed by the same kind of discharge, and consequent relief. The nares, especially the left nostril, now seemed to be growing more stopped, nasal respiration began to grow difficult, and at night painful, the pain being referred to the nucha and occiput. The patient now began to lose flesh and sleep, and became markedly weak in his muscles, and the nasal douche, which he had used once or twice, gave no further relief; in fact, the obstruction in the left nostril became almost total, Valsalva's inflation became more and more difficult, and both taste and smell failed. By April 27th, two months after first seen, Valsalva's inflation had become impossible, and the fluid was drawn from the left tympanum, after paracentesis, by means of suction with Sigle's speculum. The Eustachian catheter caused pain, and its use was not persevered in. The almost constant and great pain in the nucha was probably due to congestion of the vertebral veins.

The aural symptoms may be considered due largely, if not entirely, to the mechanical obstruction of the pharyngeal mouths of the Eustachian tubes.

On July 10, 1881, Doctor X—— died. His decline was very rapid from the date of the consultation, notes of which follow. The tumor did not grow downward to any great extent, as it never

appeared below the velum. It enlarged sufficiently, however, in that direction to interfere seriously with deglutition and speech, so that toward the end it was necessary to feed him almost entirely by the rectum, and for him to communicate with his friends by writing. About two weeks before his death he took to his bed, and at the same time there were evidences of pressure at the base of the brain.

He had marked converging strabismus, dilatation of the pupils, dimness of vision, and ptosis. He also became very dull and drowsy, sleeping most of the time. His death was comparatively an easy one, and was caused immediately by exhaustion. There was no post-mortem examination.

DR. ALLEN'S REMARKS.

Dr. X—— was seen by me in consultation with my friend, Dr. Burnett, about April 15, 1881. At that time the soft palate was intensely reddened and covered on its anterior surface with a number of nodular elevations, which probably answered to the enlarged and engorged orifices of the glands there situated. The oro-pharynx was much congested and exceedingly irritable. The nasal chambers were both perfectly normal, the left being the larger. The voice of the patient had a decidedly nasal intonation.

It appears that about a year ago several attacks of epistaxis had occurred at short intervals, and the nasal intonation became from that time noticeable. At or near the same time a dull pain was experienced in the nape of the neck. The attacks of bleeding have long ceased, but the nasal voice and the nasal pain have persisted and caused Dr. X—— to suspect that he was suffering from his old enemy, rheumatic neuralgia, with a complication of nasal catarrh.

At the time of the above examination, nasal respiration was almost impossible.

Examination was much interfered with by the almost incessant efforts of the patient to clear the pharynx of tenacious mucus.

The rhinal mirror detected a swelling on the left side of the vault of the naso-pharynx. The Eustachian fossæ were congested,

but in other respects appeared to be normal. The finger, being introduced into the naso-pharynx, defined the swelling to be of the size of a chestnut, having a broad base and almost entirely occluding the left posterior naris. Considerable bleeding ensued upon the manipulation, and the patient acknowledged more distress than usually follows this rather disagreeable test.

April 22d, I saw the patient again, and succeeded in detaching a portion of the pharyngeal mass with the finger. This fragment, when submitted to Dr. Carl Seiler for microscopical examination, was found to be a portion of a small-celled sarcoma.

I saw Dr. X—— on three other occasions, but had no reason to change the opinion previously formed, that the patient was suffering from a vascular malignant growth at the pharyngeal vault, sessile in form and occluding the posterior naris of the left side.

The treatment was simply palliative, though the doctor was informed that an operation was, in my judgment, justifiable. The operation I proposed was a removal of the projecting mass in the pharynx, with the object of increasing the degree of nasal breathing. But the idea of an operation was so repugnant to the patient's feelings that the proposition was not urged. It was well that nothing of the kind was attempted, for, in the light of subsequent events such a procedure would most likely have simply precipitated the fatal issue.

I saw the case for the last time in consultation with Prof. D. H. Agnew, who confirmed the views entertained by Dr. Burnett and myself, as to the nature of the case. The mass had by this time extended across the vault, and the degree of pharyngeal congestion had greatly increased.

A word of explanation is demanded respecting the nasal respiration. The mass, while lying on the left side, is described as occluding the left naris only; yet the arrest of the nasal respiration was absolute. It has already been seen that the left side of the nose was the larger. There is no doubt that nasal breathing was carried on almost entirely on the left side, and when this side was filled by the growth, the general congestion of the pharynx was sufficient to occlude the already narrowed right chamber.

ANOMALIES OF THE MEMBRANA TYMPANI AND OSSICLES FROM INTERRUPTION OF INTRATYMPANIC AIR-SUPPLY.

By SAMUEL SEXTON, M.D.,

NEW YORK.

A PERVERTED development of the membrana tympani is of such frequent occurrence that every otologist is familiar with its appearance; but, for the guidance of those whose opportunities for observation are more limited, it shall be the object of this paper to describe some of the characteristic peculiarities of these changes in the membrane and ossicles, and to present the etiological factors which seem to be concerned. When these anomalies are examined by means of the aural speculum and head-mirror, the malleus handle is seen to be deflected posteriorly across the membrane, where it occupies a position more or less parallel to the posterior fold of the membrana flaccida, which is usually much more prominent under these circumstances. Between the handle of the malleus, thus displaced, and the posterior fold of the membrana flaccida, the tympanic membrane is thrown into two or three folds which radiate, fan-like, from the short process of the malleus.

The long process of the incus, in some instances, may be seen lying behind one of these folds.

The malposition of the malleus in these cases increases the prominence of the short process, which thus pushes the upper border of the membrane outwardly, and, in some instances, appears about to force its way through it.

The membrana tympani, when thus elevated and put upon the stretch by the projecting short process, falls away from that prominence in folds, the general appearance of which resembles the creasing of a half-closed umbrella from which the feruled stick projects.

The folds that fall away posteriorly depend for their size on the degree of the manubrium's deflection; for, in assuming its false

position, it pushes the posterior segment of the membrana tympani up before it, the relaxed membrane arranging itself into folds, as has been stated. Where the displacement of the malleus has not been very great, the manubrium is foreshortened, and the relaxed membrane may be pouched out instead of being thrown into folds.

As has been stated, smaller folds are sometimes to be seen in these cases: when extending away in front of the short process they lie below the fold of Shrapnell's membrane, and very often the mere suspicion of this appearance is given to the membrane both below and above the short process.

Viewed as a whole, the entire upper portion of the membrana tympani seems to be much more prominent than natural, a condition that depends, in a measure, on the altered position of the ossicles; but it seems relatively to have greater prominence on account of the retraction of the inferior segment and the consequent foreshortening of the manubrium. The anomalous condition of the membrana tympani varies, of course, with every case—the characteristic changes depending on the age of the patient, or on the causes that give rise to the trouble.

In these cases there is nearly always coexistent chronic catarrhal inflammation of the middle ear, which gives the membrana tympani the appearances due to its influence.

When an explanation is sought for the anomalies which I have attempted to describe above, we must not lose sight of the conditions that should surround the membrana tympani during the period of its development. For its development and for the performance of its functions, it is well known that the drum-head requires the presence of air on both its external and its internal surfaces; indeed, the tympanum, inclusive of the transmitting mechanism, comprises the superior terminus of the air-passages, and may be considered to be as dependent for its development on a normal air-supply as the pulmonary structures themselves.

Now, when, from any cause, during the developing period of childhood, the normal air-renewal in the tympanum does not take place, the development of the parts is perverted. The membrana tympani, which at birth lies in an almost horizontal plane, and which, during its development, gradually assumes a plane approach-

ing to the perpendicular, now yields to the air-pressure from without, and while the superior segment is apparently projected outwardly by that portion of the malleus to which it is immediately attached, the inferior segment is actually retracted to the greatest possible extent by the uninterrupted and unopposed pressure of the air from without.

During the period of growth of the temporal bone the annulus tympanicus of course retains the circumference of the membrana tympani which is attached to it, in an immovable condition, but while the circumference of the membrane, during the transition of the unyielding osseous structure from a horizontal to a perpendicular position, is thus made to follow an unvarying course, the inferior segment is greatly retracted by the air-pressure upon its external surface; the handle of the malleus is thus retained in an abnormal position, and as the development of the ear now progresses, the membrana tympani draws upon this bone more and more, until either malleo-incudal luxation occurs, or the incus itself is drawn out of place along with the malleus.

Respecting the conditions which interfere with the air-supply of the tympanum, and thus give rise to the anomalous development of the membrana tympani under discussion, they may be included under two heads: 1st, structural changes that interfere with the physiological movements of the pharyngeal muscles; and 2d, structural changes that by closure of the guttural mouths of the Eustachian tubes prevent the entrance of air by mechanical obstruction.

The most important of these causes is chronic catarrhal inflammation of the naso-pharynx, the Eustachian tube, or of the middle ear—usually of all three at the same time.

Enlargement of the tonsils, which frequently occurs in connection with catarrhal inflammations, not only contributes to the prevention of air-renewal in the tympanum by interfering with the physiological functions of the pharynx, but it is believed that in some instances these bodies also prevent the entrance of air to the Eustachian tubes by the direct pressure they induce on their pharyngeal mouths.

In very young children these obstructions to the free passage of air through the pharynx, or the nose, compel habitual mouth-

breathing, and, inasmuch as it has been ascertained that the air, which should be gently forced up into the tympanum with every act of expiration and withdrawn again during inhalation, fails to enter that cavity unless the act of respiration is performed *with the mouth closed*, it is very evident that the normal air-supply is thus excluded in a large number of instances at an important period in the development of the ear. Pressure from without is, in the meantime, uninterrupted.

The characteristic changes in the membrane may be found at a very early period in these cases, even before it is practicable to estimate the impairment of hearing; the latter symptom, however, very often exists to a degree that greatly incapacitates the child; such children may be backward in learning to talk, and, of course, they learn slowly at school.

When the tympanum of the infant has never been aërated, the acoustic organ is deprived of the service of the sound-transmitting mechanism, and deaf-mutism results; it is also probable that in such cases the auditory nerve suffers deterioration from disuse—a very serious matter as regards the acquisition of articulate speech.

The appearance of the membrana tympani in these cases usually indicates the coexistence of catarrhal inflammation of the middle ear; the membrane having lost its brilliancy through this cause, and through trophic changes as well in some cases, is changed in color. In the very young it usually appears to be somewhat humid, and when it lies upon the inner wall of the tympanum it is indistinguishable from the lining membrane of that cavity.

The possible effect of the action of the tensor tympani muscle in these cases is not to be overlooked; I have not myself made any special study of this aspect of the trouble.

Deafness is not always very great in these cases, and I believe that I have observed an improvement to take place in this regard, in certain instances, as the child grew older. I have observed that the characteristic deformity of the membrane, in some instances, has remained almost unchanged until long after the patient had obtained his full growth; the defect is then permanent.

In some of the children who were found to be very deaf from the conditions above described, I have observed that when the

Valsalvian experiment had been practised the lower segment of the membrane was very much bulged out, and that the malleus handle was drawn outward and downward. Before this procedure the manubrium, owing to the foreshortening, was scarcely recognizable. I have frequently discovered this relaxed state of the membrane in children above the age of ten years, and have found that the deafness has been of a variable nature. It is in such cases that the inflation of the middle ear by Politzer's method causes such marvellous, but temporary, improvement in hearing.

A CASE OF MICROTIA.

By W. H. ROBB, M.D.,

AMSTERDAM, N. Y.

The subject of the accompanying illustration, a boy eight years of age, was born in this country, of German parentage, the tenth child, and the only member of the family having any deformity.

He was seen by the writer in a school, which he attended in common with hearing children, and where it was found that he could hear distinctly across the room, fifteen feet away from the speaker, every word spoken in an ordinary tone of voice; this he did with his back turned to the speaker; in the same position he could hear a sharp whisper at a distance of six feet. At this latter distance he could also hear distinctly words spoken in a low tone, his mouth, nose, and eyes being tightly closed.

The patient was submitted to Dr. Featherstonhaugh, of Albany, N. Y., for his inspection, and he submits the following report:

"On superficial examination the helix, with lobule, seems to stand straight out from the side of the head, making a prominent ridge over the site of the ear, as is plainly shown in the accompanying plate. The length of the auricle from apex to end of lobe is three and one-half centimetres on each side. There is an irregular piece of cartilage, of a somewhat triangular shape, occupying the extreme upper part of the auricle. The cartilage is perhaps three times thicker than normal, and is very mobile beneath the skin. The base of this triangular pyramidal piece of cartilage stands parallel, or nearly so, to the horizontal diameter of the surface of the temporal bone. The apex is directed nearly straight toward the head. The pieces of cartilage are, however, exceedingly rough, with little elevations and depressions. Both auricles appeared to be similarly and to an equal degree deformed. There could not be found, on the most careful and long-continued exploration, any de-

pression corresponding to the meatus. The temporal bone feels perfectly smooth, as the finger is passed over the flabby integument. The mastoid processes are normal in size; the head is well developed. The child has an idiotic look and a broad nose. There is a small apparent opening one centimetre from apex of left ear, which seems to be a trace of the fossa of the helix. This is about large enough to admit the end of an ordinary probe, and is about one line in depth. The bottom of this, however, can be readily seen, and it is nothing but a sulcus. The right ear has the same depression, but the fossa is higher up, and is about half as deep.

"The H. D. could not be accurately determined, for the reason that the child was timid, and would hear the watch anywhere. I came to the conclusion that he could not hear the watch (normal hearing distance of watch, 120 inches) except on pressure. Experiments with tuning-forks were of no value. Placed at fifteen feet away, he could hear what was said, if spoken clearly and distinctly, or with some elevation of voice. His mother's voice, which is quite sharp, he could hear much better than mine. I could not determine whether there was any difference in H. D. between the two ears; no difference was appreciable. The pharynx was examined with difficulty, and found normal.

"The mother says that the boy is as bright as any of her children, and that he goes to school, and learns as well as any child of his age. This statement is confirmed by his school-teacher. I should be inclined to take this *cum grano salis.*"

A NEW DEVICE FOR HOLDING THE EAR AND THROAT MIRROR.

By J. P. WORREL, M.D.,

TERRE HAUTE, IND.

Various modifications of the head-band, for holding the ear and throat mirror, have been made, with only partial success in diminishing the annoyance attending its use. It has seemed to me that the objections to the band are intrinsic, and that something other than a band must be devised, and that the device should possess the merits of durability, absolute cleanliness, ready adjustability, and sufficient firmness to maintain the mirror in place

while in use. Accordingly, I have had Mr. Gemrig, of Philadelphia, make for me a head-spring that seems to meet the requirements. A nickel-plated steel spring, three-fourths of an inch wide, is attached in front to the forehead plate, and behind to a plate of hard rubber—the occipital plate, two and one-half inches long, and slightly concave on its inner surface. The spring should be of sufficient strength to grasp the head firmly, and should be so curved that when the forehead plate is in position, it

may rest lightly upon the top of the head, with the occipital plate grasping the back of the head in the position of the occipital protuberance. In my instrument the forehead plate is that ordinarily supplied with the mirror. Others might prefer to have both the forehead and occipital plates longer, and curved so as to grasp the head more firmly, though I have found the dimensions given to sufficiently answer my purpose.

The adjustment or removal of the instrument may be instantly made by means of one hand, and when in place it affords a firm support to the mirror. The *coiffure* is undisturbed, and none of the discomfort that comes from the juxtaposition of an offensive rubber band is experienced. This means of attaching the head-mirror is so simple and effective that I am by no means likely to have been the first to devise it. Since, however, I can find no description of a similar apparatus in the journals, I give the description, with the hope that the spring may prove as satisfactory to others as to myself.

VASCULAR TUMORS OF THE MEMBRANA TYMPANI.[1]

By ALBERT H. BUCK, M.D.,
NEW YORK CITY.

A lady, sixty-five years of age, consulted me on the 8th of June, 1881, for a slight impairment of the hearing, of only a few days' duration. As the other features of this case are of no particular interest, I will simply describe the unusual conditions which I observed in both drum-membranes. In the central portion of the posterior superior quadrant of the left tympanic membrane, perhaps a trifle nearer the posterior fold than the manubrium mallei, and surrounded by a narrow zone of normal drum-membrane tissue, was a dark object which stood out in bold relief from the outer surface of the membrana tympani. I manipulated this object with a slender silver probe, and in this way ascertained that it was sufficiently soft to yield to the pressure of the instrument; that it was shaped like a mole or teat; that it measured about one millimetre in diameter at its base, and projected a distance of at least one millimetre from the plane of the surrounding membrane; that it was not noticeably sensitive, and that the transition from the black of the tumor to the grayish white of the healthy drum-membrane was abrupt.

In the right ear I found a similar vascular new-growth in almost precisely the same region of the tympanic membrane; it was smaller, however, than that of the left ear. While the latter represented a perfect vascular mole of diminutive proportions, the former consisted simply in a low, hemispherical eminence, recognizable more by its dark color than by any change which it caused in the configuration of the drum-membrane.

On questioning the patient with regard to her past history (aural), I learned that in 1868 or 1869 she had consulted an emi-

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[1] Read before the American Otological Society, July, 1881.

nent aurist in Germany, on account of what she termed a "neuralgia" of the left ear; that he had advised her to let him incise the left tympanic membrane; that the operation was then performed, but that she experienced no relief from it. From this history I infer that even at that time the vascular tumor which I have described existed, and that it was believed by the surgeon who discovered it to be connected in some way with her attacks of neuralgia.

The case was treated as one of simple Eustachian and middle-ear catarrh, and the vascular growths were allowed to remain undisturbed.

Vascular tumors of the otherwise healthy membrana tympani are, I believe, quite rare. At all events, Schwartze, in his "Pathological Anatomy of the Ear," does not enumerate vascular tumors among his list of pathological conditions observed in the otherwise healthy tympanic membrane.[1]

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[1] In my work on diseases of the ear, published last year, I reported (p. 372) a somewhat similar case. "In a young lady, twenty-two years of age, who consulted me for a slight general impairment of her hearing, I found in the posterior superior quadrant, just behind the short process of the hammer, and encroaching a little upon this bone, a small, rounded, bright red fleshy mass, about as large as a No. 12 shot (*i.e.*, about a millimetre or a millimetre and a half in diameter). It appeared to be quite soft, and was freely movable when manipulated with the probe; at the same time it was not pedunculate. In the present instance this vascular nævus possessed no significance beyond that of a mere pathological curiosity; and yet there is no good reason why, in this case, at some future day, a more extensive tumor of this kind may not be found growing from the membrana tympani." As will be remarked, the tumors in these two cases differed from each other decidedly in color, the one being of a bright arterial hue, the other almost black.

MEETINGS OF SOCIETIES.

PROCEEDINGS OF THE AMERICAN OTOLOGICAL SOCIETY.

The fourteenth annual meeting of the Society was held in Newport. R. I., July 26, 1881, there being eighteen members present; the President, Dr. J. Orne Green, of Boston, in the chair.

The first paper was read by Dr. S. Theobald, of Baltimore, and was entitled

SUGGESTIONS REGARDING THE TREATMENT OF SUPPURATIVE OTITIS.

The author directed especial attention to the free use, by insufflation, of a powder composed of equal parts of boracic acid and oxide of zinc. In some cases he had used boracic acid and alum, and, in a still smaller number of cases, the oxide of zinc alone. The powder composed of boracic acid and oxide of zinc was so mild in its action that it could be used in the painful stage of otitis media. The ear should be carefully cleansed by syringing, and the powder blown in freely with an insufflator. Dr. Theobald reported eight cases in which marked benefit had followed the use of the powder; and while he did not wish to claim that it was invariably successful, he recommended it as a valuable agent in the treatment of that class of cases.

In reply to a question asked by Dr. Blake, of Boston, Dr. Theobald said he thought the powder could be blown into the upper part of the tympanic cavity.

Dr. H. D. Noyes, of New York, had employed, with benefit, equal parts of tannic acid and boracic acid, and believed the com-

bination to be more serviceable than either substance when used alone.

Dr. Samuel Sexton, of New York, had not derived satisfactory results from the use of Dr. Theobald's plan of treatment in acute cases, but in the more chronic cases the results had been pleasing, and especially so when the boracic acid had been combined with calendula (twenty-five or fifty per cent.). He had used the latter because of its reputed healing properties.

Dr. C. J. Kipp, of Newark, N. J., had abstained from using powders because he regarded it good surgery to give free exit to accumulations of pus.

Dr. C. H. Burnett, of Philadelphia, had usually used the boracic acid alone, and with satisfactory results. But he had introduced only sufficient to cover the walls after cleansing with a syringe, and rather as a drier in the latter stages of muco-purulent affections.

Dr. J. O. Green, of Boston, had used boracic acid with satisfactory results, especially in hospital practice, and had employed it in large quantities, filling the meatus one-eighth or one-half full. It was so readily soluble that it had not prevented free flow of the discharge. To be serviceable it must be in the form of an impalpable powder, and Mawson's pulverized boracic acid was the only reliable article which he had been able to obtain.

Dr. John Green, of St. Louis, regarded the oxide of zinc as a remedy which could be used with positive benefit.

Dr. A. H. Buck, of New York, referred to Reynders' powder-blower, which has a slender tube that can be readily introduced into the meatus. He regarded it as a convenient and durable instrument.

Dr. J. O. Green had used boracic acid very freely in profuse otorrhœa, and with decided advantage. He referred to a case of double chronic otorrhœa, in which, within three weeks, the discharge ceased, the granulations, which were large, shrivelled, and without other treatment the case progressed favorably.

Dr. Sexton referred to a case in which the discharge was retained in consequence of packing the meatus with boracic acid. He thought it well to direct the patient to syringe the ear as soon

as the slightest persistent pain developed. He also had frequently seen granulations disappear under the use of this remedy. He preferred to introduce the powder through a speculum and push it down into the meatus with cotton.

Dr. D. B. St. John Roosa, of New York, read a paper on

THE VALUE OF OPERATIONS IN WHICH THE TYMPANIC MEMBRANE IS INCISED.

He said that he had given up all operations with the knife in cases of chronic proliferous inflammation, or non-suppurative disease, except when, perhaps, there were adhesions between the ossicles, or between an ossicle and the promontory, and there was no suspicion of retained mucus or other fluid in the tympanic cavity. In cases of accumulation of pus or mucus in the tympanic cavity, we had, without reasonable doubt, entered upon a hopeful arena; and paracentesis, for the most part, in acute and subacute cases, was as great an addition to our means of effecting a cure as had ever been made. The operation must always be performed with gentleness. Red and swollen as might be the drumhead, the proper employment of leeches sometimes saved the patient from the cutting operation. He favored the gentle method; when it was necessary to perform the operation, he made a small incision, used a small knife, and believed the operation should not be performed too soon.

Dr. C. J. Blake, of Boston, favored the small incision, and for some time had used a simple needle. In cases in which there was severe pain, considerable congestion at the upper part of the membrane, bulging caused by compressed air, he had made what might be called a "dry puncture" at the point of greatest prominence; a sharp hiss had been caused by the escape of air, and in several cases the pain had, in a measure, been relieved, and usually the opening had been utilized within twenty-four hours for free serous discharge, with corresponding relief.

Dr. Buck regarded Dr. Roosa's statement, concerning operations upon the membrana tympani, as a very fair one, and said that

no single statement could reflect the average sentiment of otologists more truly than the one made. He agreed with it in all essential points.

Dr. C. J. Kipp fully endorsed the general sentiment expressed by Dr. Roosa. Formerly he performed the operation of paracentesis very frequently; so frequently that Dr. Sexton once referred to his report of cases as evidence of its abuse. Latterly, however, he had resorted to it only in acute cases. In acute inflammation of the middle ear associated with scarlet fever, he resorted to the incision only when there was a circular appearance, with bulging of the membrane.

In the class of cases called by Dr. Buck inflammation of Shrapnell's membrane (or of the posterior fold), he had invariably made an incision, and always with benefit, although the quantity of fluid which escaped might be small.

Dr. H. D. Noyes accepted the general statement made by Dr. Roosa. He preferred, however, to make a free opening in acute cases, because of the tendency to closure, and thus preventing the free discharge of the fluid. He had performed the operation almost exclusively in acute cases; and, in order to make the incision with accuracy, the mirror should be used.

With reference to aural inflammation with scarlet fever, he had reached nearly the same opinion as that expressed by Dr. Kipp. If there was a great deal of pain, considerable resistance of the membrane, with or without bulging, he had found it to be advantageous to make a free incision. On the other hand, in cases in which ulceration goes on rapidly, and speedy egress to the fluid would be afforded by natural processes, an incision was disadvantageous.

Dr. J. S. Prout, of Brooklyn, several years ago attempted to make a permanent opening in the drumhead in a case of chronic non-suppurating inflammation, and the improvement in hearing in that case was very marked for several months, but gradually the opening closed, and finally the hearing was no better than if the operation had not been performed.

In a second case he performed the same operation, and the result was a permanent suppurative inflammation; and, in view of that

result, he had not attempted to apply the method of treatment since.

In the acute inflammatory conditions, when there was accumulation of fluid, bulging of the membrane, and the case was especially painful, he felt like making an incision in the drumhead.

Dr. C. H. Burnett heartily subscribed to what Dr. Roosa had formulated, but would add that he always incised when he thought there was any fluid behind the membrane. He regarded the gentleness of the operation as very important, and his method was first to simply stab the membrane, making the smallest possible opening, and if then the fluid did not flow freely, the puncture could be slightly enlarged. He also agreed with Dr. Prout in that it was not wise to wait too long, for dangerous complications might occur, and besides, there was advantage in having the surgeon select the position for the opening.

Dr. Sexton said that he had not had experience in operations upon the drumhead for improving impaired sense of hearing. Nor had he been in the habit of frequently perforating the membrana tympani for the purpose of liberating fluids. He did not regard the mere existence of either serous or purulent fluid in the tympanic cavity as a condition which always indicated paracentesis of the drumhead. If he was to be guided by any single condition, he would say that if the membrana was upon the point of giving way from ulceration, he should not wait; but neither bulging of the membrane nor the neuralgic pains, which are so frequent a symptom in these acute cases, would necessarily induce him to operate, for he believed that extension of the inflammation to the brain depended more upon continuity of structure than upon the presence of fluids in the tympanum. His practice had been to prescribe internal remedies for the relief of the inflammatory process, and the one chiefly relied upon, perhaps, was the sulphide of calcium in doses of from one-tenth to one-half grain. He did not rely upon the calcium entirely to give relief to pain, but gave, in addition, some preparation of aconite in small doses frequently repeated. The use of leeches he had long since discarded.

ANÆSTHETICS IN PARACENTESIS OF THE MEMBRANA TYMPANI.

Dr. Noyes, in performing the operation in acute cases, always gave an anæsthetic: ether in the young subject, and in the adult patient either ether or chloroform, administered only sufficiently to produce primary anæsthesia.

Dr. Prout said that when Dr. Mathewson, nine years ago. incised the drumhead in one of his ears, he did not experience so much pain as he had anticipated. Blood and mucus escaped, and he was certain that it would not have been so well to have waited.

Dr. Noyes said that he incised the drumhead in one of Prof. Bryant's ears, and the patient said that he would not submit to the operation again without an anæsthetic.

Dr. E. W. Bartlett, of Milwaukee, Wis., assented to the general statement made by Dr. Roosa. The only operation which he performed was paracentesis, and if the knife was well pointed, perfectly sharp, so that it would pass through kid noiselessly, the operation with it was painless. He believed that it was safer to make the opening too early than too late, and if left to be made by nature it was apt to be in the wrong place.

Dr. Blake rarely used anæsthetics in this operation.

Dr. Buck had used anæsthetics only very rarely when performing the operation upon adults, and could not recall a case occurring in children from one to three years old in which he had found this necessary.

Dr. A. Matthewson, of Brooklyn, had not had a favorable experience in operating upon the drumhead in non-suppurative cases. In the acute suppurative affection, if the pain did not subside within a short time, he resorted to puncture of the membrane.

Dr. Burnett had not used anæsthetics. In acute cases his patients had not complained of pain from the operation; but in some of the cases of so-called chronic catarrh, incision of the drumhead had given rise to considerable pain.

Dr. J. O. Green remarked that the testimony seemed to be so uniformly in favor of incising or puncturing the drumhead in acute cases of accumulation of fluid within the tympanic cavity, he would ask if any one favored the older operations, such as the use

of acids, etc., which Dr. Roosa had condemned in chronic non-suppurating affections.

Dr. Theobald agreed with the general inadvisability of incising the drumhead except for the purpose of promoting the escape of some accumulation. In many cases of chronic inflammation in which there was fluid in the tympanic cavity, the accumulation could be gotten rid of without making an incision, and in such cases he thought that the catheter was more useful than Politzer's method. To check the inflammation in acute cases, he recommended instillations, three or four times a day, of a solution of atropia four grains to the ounce of water.

Dr. Buck thought all present were so perfectly in accord with the general statement made by Dr. Roosa concerning the cutting of tendons, opening the membrane with acids, etc., that no one could wish to prolong the discussion.

Dr. D. B. St. John Roosa, of New York, then read a paper on

THE TUNING-FORK IN DIAGNOSIS.

This paper contained the following propositions :

"I. If one ear be normal as to hearing power, and the other abnormal, and a vibrating tuning-fork be placed upon the vertex or the teeth, if its sound be intensified in the ear whose hearing power is diminished, there is disease of the external or middle ear, but not lesion of the labyrinth or nerve.

"II. If, under the same conditions of a sound ear on one side, while the hearing power of the other is impaired, the tuning-fork be not heard better in the worse ear, even if the meatus be stopped by the finger or the like, there is disease of the labyrinth, the acoustic nerve, or brain.

"III. If the vibrating tuning-fork be heard better on the mastoid than when placed in front of the meatus, there is disease predominantly of the middle ear.

"IV. If the tuning-fork be heard better through the air than through the bones, there being impairment of hearing, the disease which gives rise to this symptom is situated in the brain, nerve, or labyrinth."

Dr. Blake, of Boston, had found it necessary to use a number of tuning-forks of different letters for purposes of testing, for in some cases the patient did not hear one tone, while he might hear another.

The second proposition offered by Dr. Roosa brought up the question of communication of vibrations through fluids, which was the particular question in view in a series of experiments which he had been engaged upon during the past year, but had not yet completed. The results of the experiments so far went to show that a considerable impairment could be obtained by the transmission of vibrations through fluid in a solid or closed space. It was, therefore, possible to imagine a condition in which, as the result of intra-labyrinthian pressure, the vibrations of the organ of Corti would be impaired.

Dr. John Green, of St. Louis, suggested that the head was a positive resonator, and that the power of conduction varied in different patients.

Dr. Blake said that, from experiments which he made six years ago, he could say that there was a range of very nearly an octave difference in the resonant power of the mastoid cavity in man. In different animals there was also a marked difference.

Dr. J. Orne Green, of Boston, then read a paper entitled

REMOVAL OF A FOREIGN BODY BY DISARTICULATION OF THE AURICLE.

(This paper is reproduced in full in this number of the Journal.) Dr. Green commented upon the adverse criticism of the operation made by Dr. S. D. Gross, of Philadelphia.

The paper was discussed by Dr. Roosa—who had performed the same operation, and who was surprised at Dr. Gross' statements—and also by Dr. Noyes.

Dr. C. H. Burnett, of Philadelphia, then read a paper entitled

MALIGNANT GROWTH IN THE NASO-PHARYNX, WITH EARLY AURAL SYMPTOMS.

(This paper, also, is reproduced in full in this number of the Journal.)

The symptoms referable to the ear were due to obstruction of the pharyngeal extremities of the Eustachian tubes. Both drum-cavities filled twice with fluid. No autopsy could be obtained.

Dr. Roosa asked Dr. Burnett if he thought that the improper use of the Turkish baths mentioned in the clinical history was what led to the development of the primary disease.

Dr. Burnett replied that there was a connection between the two in point of time, and the patient, an intelligent physician, believed that the relation was one of cause and effect. Dr. Burnett's own opinion was that Turkish baths, improperly used, might give rise to naso-pharyngeal catarrh.

Dr. Roosa remarked that he had recommended such baths for patients who were constantly taking cold, but had not seen much benefit from the remedy.

Dr. C. J. Kipp, of Newark, N. J., then read a paper containing the history of a case of

EPITHELIOMA OF THE MIDDLE EAR.

It developed from a preceding otorrhœa, and was the only case in which he had met with the disease in that region. The growth was attached around the wall of the meatus.

SELECTION OF TEST-WORDS ACCORDING TO THEIR LOGOGRAPHIC VALUE,

was the title of an oral communication made by Dr. C. J. Blake, of Boston, which was as follows:

In default of a single adequate test of hearing power, and the necessity, therefore, for the employment of a series of tests, comparative merely, and each including only a portion of the scale of audition, it is, of course, important that the standard of each of these controlling tests should be as nearly as possible definitely determinable.

Of the various means of testing at our command, the human voice, while of great comparative, is of but little absolute individual value, for the obvious reason that its great variability and the extreme difficulty of insuring or of measuring any fixed degree of

intensity which may be acceptable as a standard, render it unreliable for purposes of exact investigation. Still, the fact that in the majority of cases of aural disease causing deafness, it is the diminished power of hearing the human voice which has led the patient to seek relief, emphasizes the importance of including the voice in the series of tests which may be used in the first examination, or continued for comparison during the course of treatment. Much indeed may be done toward arriving at an idea of the degree of disability in this respect, by a careful use and modulation of the voice in conversation with the patient, especially if words are judiciously chosen and justly articulated. At the best, however, a test of this sort is but vaguely comparative, and its result must often be accredited rather as an impression of the amount of the disability than as a measure of its degree.

The selection of a series of test-words is a step forward in the direction of a determinable standard, though, upon whatever basis the selection is made, it leaves much to be desired on the score of accuracy, until more adequate means of determining the sound value of the human voice are discovered than at present seem possible.

With the accurate means at our command for testing the hearing for pitch, by the aid of musical instruments, the selection of test-words according to the musical value of their component consonant-sounds would seem to be, in a measure, superfluous, and for this reason I have preferred, instead of using the consonant combinations suggested by Wolff and others, to make a selection based upon the logographic or force value of the consonant-sounds.

The method of making logographic tracings has already been sufficiently described elsewhere.

In utilizing these tracings for the purpose of comparing the force values of the consonant-sounds, the tracings, made upon smoked glass or mica, are placed upon paper ruled in squares of millimetres and tenths, and the number of these divisions included within the space bounded by the logographic curve and its base line is taken as the logographic value of the consonant-sound trace expressed in assumed units of force.

The comparison of a large number of tracings goes to show

that while the force value of the consonant-sounds differs largely in different individuals, and differs also in the same individual at different times, the comparative value of the consonant-sounds one to another bear a fairly, though by no means absolutely definite ratio. If, therefore, we take the consonant-sound which requires the greatest force in its production—which has, in other words, the greatest logographic value, and which would be most readily heard, and express its value as one hundred, and that of the other consonant-sounds accordingly, we have a table from which we may select the materials for a list of test-words, based upon the intensity rather than upon the pitch of the voice force produced, and serving, as in cases of chronic middle-ear disease, for instance, as a measure of the obstruction presented to the passage of the sound. In compounding words from this table it is better to use monosyllables, and it should, moreover, be kept in mind that the logographic value of consonants formed at the back of the mouth is greater in combination with the lower pitched, and of the front consonants in combination with the higher-pitched vowel-sounds. The logographic value of T, for instance, is somewhat greater in the word *tip* than *top*, and of G in *got* than in *get*.

T	100.	C	62.
B	53.	F	35.
P	58.	K	31.
D	45.	L	21.
G	56.	N	11.
S	40.	M	9.
Z	53.		

Dr. C. H. Burnett asked Dr. Blake whether he used the same test-list in every case. Also whether he had a large enough list to draw from, so that the patient need not learn tests by heart, and thus know what to anticipate. He had, in testing, endeavored to select a variety of words and avoid testing all patients alike.

Dr. Blake said that a large variety of words was most important. He had a large list from which to make selections upon each time he had occasion to test the hearing.

Dr. A. H. Buck, of New York, then read a paper entitled:

SUDDEN AND COMPLETE LOSS OF HEARING DURING AN ATTACK OF MUMPS.

The paper contained the histories of two cases, with remarks. The first was that of a girl, who, on the third day of an attack of mumps, had sharp pain in one ear, and, on the following day, discovered that she had lost the power of hearing in that ear. The second case was that of a man in whom deafness developed in one ear without pain during an attack of mumps. In one case both parotid regions were equally affected; but, in the other, only one side was involved. He believed that the cochlea alone was invaded in one case, while in the other both the cochlea and the semicircular canals were probably affected.

Dr. Burnett asked for the evidence of the labyrinthian disease.

Dr. Buck replied that Vogel's statement had led him to that conclusion. It was evident that the auditory nerve was affected—whether in the labyrinth, or in the cranial cavity, or in the medulla oblongata, he would not be positive; but, with such anatomical relations as existed, it would be natural to assume that the inflammatory trouble existed in the cochlea rather than in some more remote region.

Dr. Burnett's experience had led him to the conclusion that in this class of cases the lesion was in the middle ear, catarrhal in character, and produced by congestion about the parotid gland.

Dr. J. O. Green had been satisfied, for a number of years, that, in a certain percentage of cases, middle-ear changes developed after labyrinthian trouble had existed for some time.

Dr. Roosa remarked that he had already alluded to that point in discussing deafness caused by cerebro-spinal meningitis. He had seen cases in which there were no changes, appreciable by him, in the drumhead, and yet the deafness was absolute; but with the lapse of time came changes, affecting the membrana tympani, which were marked. He thought that slight injustice was being done to the subject by not investigating the labyrinth as ophthalmologists did the retina and the optic nerve, and he be-

lieved that, in the light of recent experiments made by Moos, it would soon be possible to diagnosticate acoustic neuritis.

Dr. Kipp thought the fact was often overlooked that a great many cases existed in which hearing was perfect and yet the drum-head presented morbid appearances. Besides, we should reason somewhat from analogy; there were but few cases of acute inflammation of the middle ear in which deafness was developed with such rapidity as had been observed in the cases under discussion.

Dr. Sexton remarked that cases of otitis media had frequently been brought to his notice where the subsequent development of an unsuspected attack of mumps seemed to account for the aural disease. He was inclined to the belief that the ear was affected in these cases through nervous sympathy.

Dr. Burnett said that he had had opportunity to examine a very large number of cases of deafness following cerebro-spinal meningitis, and was certain that in very many of them the drum-heads were in good condition, notwithstanding the deafness was of long standing.

Dr. J. O. Green said that he did not wish to have any general conclusion drawn from his statement, as it was meant to be simply that, in some cases, at least, secondary changes involving the tympanic cavity followed labyrinthian disease.

The paper was further discussed by Drs. John Green, Prout, Kipp, Roosa, and Sexton.

Dr. Buck, of New York, then read a brief paper containing the history of a case of

SMALL VASCULAR TUMOR OF THE MEMBRANA TYMPANI.

He regarded the occurrence of such tumors in that region as very rare.

Dr. Samuel Sexton, of New York, exhibited

A FLEXIBLE EUSTACHIAN CATHETER.

It was made of soft rubber, but sufficiently firm to retain the necessary curvature of the beak *without* a stilette. The advantages claimed for it were: that it enabled the surgeon to more easily

perform the operation of Eustachian catheterization; that it was less painful to the patient than a metallic instrument; and that it admitted of greater cleanliness, as each patient might retain possession of the soft-rubber portion of the instrument which had been used in his case. [For a complete description of the instrument, with illustration, see the *Medical Record*, Vol. XX., p. 82. It is made by Tiemann & Co., of New York.]

Dr. Roosa, of New York, directed attention to

TAYLOR'S EAR-DOUCHE,

devised by Dr. C. Fayette Taylor, of New York. It possessed advantages which enabled him to warmly recommend it. It was made by Reynders, of New York.

Dr. Buck directed attention to

REYNDERS' EAR-DOUCHE,

which was especially serviceable in treating children. It consisted of a small rubber bulb, with a rubber tube carrying a pronged hard-rubber nozzle, the prongs preventing its introduction too far.

The Business Committee reported the following

NOMINATIONS FOR OFFICERS

for the ensuing year:

For President.—Dr. J. Orne Green, of Boston.

For Vice-President.—Dr. J. S. Prout, of Brooklyn.

For Secretary and Treasurer.—Dr. J. J. B. Vermyne, of New Bedford, Mass.

For Committee on Publication.—Drs. J. J. B. Vermyne, C. J. Blake, and J. Orne Green.

For Committee on Membership.—Drs. John Green, of St. Louis; C. H. Burnett, of Philadelphia; and H. G. Miller, of Providence.

The report of the committee was unanimously adopted.

The society then adjourned, to meet at 10.30 A.M., on the day previous to the first day of the annual meeting of the American Ophthalmological Society, in 1882, and in the same place.

INTERNATIONAL MEDICAL CONGRESS.

SECTION OF DISEASES OF THE EAR—August 3, 1881.

This section was opened with an address by the President, Mr. Dalby. He drew especial attention to the so-called proliferous catarrh of the tympanum, its treatment, and the various operations practised for its relief. Opinions held among aurists were very much divided as regards general treatment and operative proceedings.

A paper was read by A. Paquet, M.D. (Lille):

DESCRIPTION OF A MODIFICATION OF MYRINGODECTOMY FOR SCLEROSIS OF THE EAR.

The procedure was as follows: a puncture was made one and one-half millimetre in front of the hammer, and the membrane was divided obliquely downward and backward, in such a manner that the lower extremity of the incision was placed half-way between the umbo and the periphery, and at a point where a line drawn vertically downward from the umbo would meet it. The incision divided not only the membrane, but also the reflex tendon of the tensor muscle, or at least the tensor ligament of Toynbee. A second incision was now made in the posterior segment, two millimetres from, and parallel with, the manubrium, and then passed forward to meet the lower end of the first incision. By excising a portion of the lower end of the V-shaped curtain thus made, the perforation was rendered durable.

Dr. Guye (Amsterdam) considered that the cases proper for the operation might be divided into four classes: 1, acute inflammation of the cavity; 2, subacute or chronic catarrh of the tympanum, with mucous exudation; 3, cases of chronic catarrh of the tympanum, with grave symptoms of internal ear disease, tinnitus, vertigo, deafness; 4, doubtful cases, in which there might be acute inflammation of the cavity with great pain and fever, and without any swelling of the Eustachian tube. The cases in which he ad-

vised myringodectomy were those in which there was exudation in the cavity.

Prof. Voltolini said that the maintenance of a permanent opening in the membrana tympani was to him an unsolved problem. He recommended the incision in cases of a foreign body behind the membrane, or mucus in the cavity; again, in some cases, to reach the root of a polypus.

Dr. Loewenberg could not understand how Paquet's operation succeeded when all other operations to produce a permanent opening had failed.

Dr. Gellé (Paris) could not understand the permanence of the perforation made as proposed.

Dr. Paquet replied that he looked upon the removal of fluids, and the necessity for the establishment of a permanent opening, as the two principal indications for the operation. The latter was not obtained by incisions, but by excisions, as large as they could be made. In these the nutriment of the membrane was lessened, and this was especially the case in sclerosis of the cavity, making the likelihood of inflammation after the operation less likely, and a permanent opening more probable.

Dr. Barr (Glasgow) agreed with Dr. Guye as to the classes of cases in which the operation was demanded. In cases of sclerosis he had never seen other than a transient improvement, and a permanent opening he had never obtained.

Dr. S. J. Jones (Chicago) considered that the incision is of value where it is desirable to remove hypersecretion from the tympanic cavity, especially where the membrane has been thickened by prior disease; that opening the membrane for other reasons is usually of, at least, doubtful propriety, and that it was nearly always unjustifiable in cases where it is used merely as a means of gaining access to the cavity for further operative procedure.

Dr. Urban Pritchard (London) said there could be no difference of opinion as to the value of this operation when there is fluid behind the membrane, but asked whether, in sclerosis, it was worth while running the risk of further injury to the middle ear for the chance of improving the hearing power in those few cases where a

permanent opening is beneficial, even supposing this permanence is obtainable.

Dr. Cassells (Glasgow) had never performed tenotomy of the tensor tympani. He had performed paracentesis for the removal of fluids, and in numerous cases where there was pus in the mastoid, with great success.

Dr. Loewenberg agreed as to the use of incision in accumulations. He considered the rapid healing after the operation to be due to the antiseptic treatment used.

Prof. Sapolini (Milan) did not consider incision advisable merely to relieve pain.

The President thought the Section was unanimous in advocating incision when there was secretion to be removed. The question as to whether we could declare the operation advisable in cases of proliferous catarrh appeared to be still *sub judice*.

J. Patterson Cassells, M.D. (Glasgow), then read a paper

ON THE ETIOLOGY OF AURAL EXOSTOSES, AND THEIR REMOVAL BY A NEW OPERATION.

Hyperostosis is never seen till the osseous meatus is completely ossified; exostosis appears before the complete ossification of the meatus. Hyperostosis is of ivory hardness; exostosis, before complete ossification has taken place in the tumor, can be pierced to a varying depth. Exostosis is slightly movable, even after complete ossification; hyperostosis never. Hyperostosis is often seen without any other disease of the ear, and if an ear disease exist, there is no causative relation between them. Exostosis is nearly always complicated with another affection of the ear, past or present. Hyperostosis may exist in the meatus with normal hearing. Exostosis is almost always attended by a defect in the hearing. The removal of hyperostosis is best effected by a mechanical drill, such as dentists use. For the removal of an exostosis, a gouge is the best instrument, because the tumor can be removed at one operation, whereas a hyperostosis usually demands several operations as well as several sittings. There may be several hyperostoses in an ear, but hardly ever more than one exostosis.

Lawrence Turnbull, M.D. (Philadelphia), then read a paper on

MORBID GROWTHS OF THE EAR AND THEIR TREATMENT (WITH CASES).

When morbid growths of the ear could be reached, he recommended their removal by the knife, preventing danger of hemorrhage by the use of the ligature, clamp-forceps, a thermo-cautery, or galvano-cautery. It was most important to remove all vascular or polypoid growths as soon as they were brought to the notice of the aural surgeon. Dr. Turnbull recommended Fowler's solution of arsenic, given in small doses, to prevent the spread of malignant growths.

Discussion opened by Dr. Ménière (Paris), who considered the treatment of polypi, recommending a modification of Wilde's snare, which enabled the tube to be placed in various directions. For after-treatment, he recommended cauterization by chloride of zinc and nitrate of mercury. He was of opinion that polypi may appear without previous otorrhœa.

Dr. Guye (Amsterdam) stated that he found that multiple exostoses come to a standstill when they touch each other. Once he found an osseous bridge uniting multiple exostoses, which he removed. He could not agree with Dr. Cassells as to the differences he drew between exostoses and hyperostoses.

Dr. Gellé (Paris) related a case of polypus arising from psoriasis—therefore, when there was no otorrhœa. He found exostoses very rare in his experience, and was astonished at the number of cases occurring in Glasgow. He described and showed drawings of exostoses in the skulls of flat-headed Indians belonging to the Anthropological Museum of Paris.

Dr. Loewenberg (Paris) stated that he had also met with a case of osseous bridge uniting multiple exostoses, and removed it by the galvano-cautery, thereby improving the hearing. His experience as to the frequency of exostoses was just the opposite of Dr. Gellé's. He had never seen a case of polypus without previous otorrhœa.

Dr. Knapp (New York) stated that, through the kindness of

Dr. C. J. Blake, who had investigated these formations, he was shown some two hundred or three hundred skulls of the Mound-builders of Tennessee, at the Peabody Museum at Boston. Dr. Blake found aural exostoses in about twenty-five per cent. of these. The tumors were oblong and ragged, never completely filling the meatus. The skeletons showed no signs of syphilis. Prof. Virchow told him that these exostoses were supposed to be the result of foreign bodies placed in the ears. He did not quite agree with Dr. Guye as to the arrest of growth when the multiple exostoses met.

Dr. Urban Pritchard (London) recognized three forms of exostoses: 1st, multiple, smooth, rounded exostoses, which are hyperostoses, and due, he believed, mostly to a gouty or rheumatic diathesis, are very common among private patients—rare in hospital patients; 2d, those due to old standing otorrhœa—these are less rounded, but are also multiple and have broad bases; 3d, a very rare form, which is single, usually pedunculated, soft exteriorly, callous to touch. He showed a specimen of this variety and some microscopical sections of it. It was removed entire after softening with dilute nitric acid.

Dr. Barr (Glasgow) considered that, while exostoses belonged to the nature of tumors, hyperostotic contraction of the external auditory canal seemed to have an inflammatory origin.

Dr. Reeves (Toronto) could not agree with Dr. Cassells as to the causes and development of bony growths.

Dr. Sapolini (Milan) exhibited a new instrument for the holding and cutting off of polypoid growths.

Dr. Cassells replied.

Discussion was then opened on

LOSS OF HEARING WHEN THE EXTERNAL AND MIDDLE EARS ARE HEALTHY.

Dr. Gellé began the discussion, and made some remarks on deafness from lesions of nerve, the accommodating apparatus of the ear, and the development of the tympanum. He also showed some preparations of the organ of Corti and of the inner ear.

Dr. A. Lucae (Berlin) then read a paper on

PHYSICAL DIAGNOSIS IN CASES OF DEAFNESS WITH HEALTHY CONDITIONS OF THE OUTER AND INNER EARS.

He considered the usual determination of the condition of the inner ear, by placing a tuning-fork on the cranium, as insufficient. The proving of the functional activity is more fully determined by placing a deep fork (C), the vibrations of which have just ceased to be perceived by the acoustic nerve while placed on the mastoid process, opposite the meatus, and noting if the vibrations not perceived on the mastoid process are perceived in this position. The longer the fork is heard opposite the meatus, after it has ceased to be perceived through the mastoid, the more certainly is a complication in the sound-conducting apparatus excluded. On the contrary, should the note be heard longer from the mastoid process than opposite to the meatus, a disturbance in the sound-conducting apparatus is determined; but in this case there remains the uncertainty as to there being an affection of the inner ear present at the same time.

A paper was read by G. T. Stevens, M.D. (New York), on

CERTAIN CONDITIONS OF THE EYES AS A CAUSE OF LOSS OF HEARING BY REFLEX IRRITATION.

The next paper was by Edouard Fournié, M.D. (Paris), on

THE FUNCTIONS OF THE EUSTACHIAN TUBE.

He believed that one of the essential functions of the tube was to prevent unpleasant resonance of external and internal noises. This function assumed a permanent opening of the tube.

A paper was next read by H. Knapp, M.D. (New York), on

THE COTTON PELLET AS AN ARTIFICIAL DRUMHEAD.

Dr. Knapp preferred the wafer-shaped kind, and considered that the pellets acted as preventives of atmospheric influences, as drainage, and as having acoustic influences.

Dr. Czarda showed an artificial drum made of a disc of Lister's antiseptic silk.

Dr. Pritchard thought long drums acted best.

Mr. Cumberbatch found them useful, but related a case of an elderly man, in which the pressure must be increased the longer they are applied.

A. Gardiner Brown, F.R.C.S. Ed. (London), read a paper on

THE SENSE OF TOUCH AS A STANDARD OF COMPARISON FOR HEARING POWER.

The author said that, for examining auditory perceptivity, the tuning-fork was to be preferred to the watch. The middle C fork (=256 V. S.) was for the purpose an excellent standard of pitch. The author had conceived the idea that the point in the lessening amplitude of the vibrations, corresponding with the moment of their loss to the sense of touch in the thumb and finger of the examiner, formed an excellent and convenient standard of reference for the auditory perceptivity of the patient. Hearing power falling short of this point the author designated as *minus*, that exceeding it as *plus*, time being reckoned in half-seconds. The author preferred simply counting in half-seconds. The most suitable points for ordinary examination were over the mastoid for bone-conductivity, and at the focus of the concha for aërial waves.

Drs. Knapp and Loewenberg both objected to the method as being too uncertain for comparisons with other observers.

A paper by Edward Woakes, M.D. (London), was the next in order, on

PARETIC DEAFNESS.

This paper set forth two chief causes which induce deafness, where there is no objective abnormal condition of the external and middle ears, viz.: disease of the labyrinth or of the auditory nerve in some portion of its course or origin, which constitute one group of cases; and neurotic lesions, of a paretic character, of the muscular apparatus of the middle ear, including the Eustachian tubes, which contribute the second and far more numerous class of cases.

The present communication was confined to the latter group. The symptoms were shown to be characteristic and constant. They were negative as regards the ear, objectively positive as regards the palate and faucial region. The causes which induced paretic deafness and the treatment adopted to remove the diseases was given.

Dr. Cassells asked Dr. Woakes what sort of battery he used.

Dr. Woakes said that he always used the interrupted current.

The subject of the next paper, by Thomas Barr, M.D. (Glasgow), was

CASEOUS ACCUMULATIONS IN THE MIDDLE EAR REGARDED AS A PROBABLE CAUSE OF MILIARY TUBERCLE.

There was a general agreement that acute tuberculosis depended on a virus, and that this virus often consists of caseated products of inflammation accumulated in some part of the body. Reference was made to the facilities for the absorption of the caseated matter afforded by the blood-vessels of the middle ear and by the lymphatics—absorption by the former, leading to general tuberculosis, and absorption by the latter, leading to local tuberculosis, and especially to tubercular meningitis. There was especial danger of tubercular self-infection when such caseous collections existed in persons of scrofulous tendencies, or at the tubercular age. There was a stage in the purulent process when there was greater danger of pyæmic phenomena, but there was also a stage when the tendency to tubercular self-infection was greatest, and that was after the discharge from the ear had spontaneously ceased, or had been cured by treatment.

Dr. Knapp showed Politzer's microscopic specimens of carcinoma of the cochlea, and illustrated it by a diagram.

The following papers were then read: "Some of the Difficulties Presented in the Diagnosis, Prognosis, and Treatment of a Certain Form of Middle-Ear Deafness," by P. McBride, M.B. (Edinburgh); "The Prevention of Dumbness in Cases when it follows Loss of Hearing," by Arthur Kinsey, Esq.; "Sonorous Waves and the Acoustic Nerve," by Dr. Sapolini (Milan).

Dr. Sapolini submitted to his *confrères* some questions as to how the "sonorous waves reach the acoustic nerve": 1. Is the membrana tympani passive, or are there in it active elements of motion? 2. Must the waves of sound pass across the chain of ossicles? 3. Does the sound pass by the fenestra ovalis or the fenestra rotunda? 4. Is it the middle spiral membrane (*scala media*) which receives the sound-waves? 5. Is the endolymph of the spiral canal isolated, or does it communicate with the vestibular endolymph?

Mr. Gardiner Brown described experiments and the results he had obtained as to the "acoustic potentials of the human auricle."

Dr. Loewenberg said that he had found visual examination of the nares a great assistance in cases in which he had experienced difficulty in introducing the Eustachian catheter.

Dr. Fitzgerald described a catheter which he used in certain cases, and Dr. Knapp a bivalve nasal speculum, used for the purpose of nasal examination.—*British Med. Journal*, September 3, 1881.

FORTY-NINTH ANNUAL MEETING OF THE BRITISH MEDICAL ASSOCIATION.

OTOLOGICAL SECTION.

Wednesday, October 10, 1881.

The opening address was made by Urban Pritchard, M.D., who began by saying that general practitioners in England were, as a rule. ignorant in regard to otological knowledge, much more so than the members of the profession on the Continent and in America. He believed that this resulted from two causes:

First.—A profound contempt for aural surgery; and

Second.—A want of knowledge of what aural surgery can do.

Can we not do something to induce our examining bodies to include aural surgery in their examinations?

Discussion on the address was invited, and Dr. Loewenberg (Paris) said that, in France, aural surgery was as much neglected in the schools as in England. The elements of aural surgery should

be taught, at least, to every practitioner. Special knowledge could not be expected of all practitioners; but at least they should be taught not to do harm.

Mr. Cresswell Baber agreed with the previous speaker, and Dr. Jacob (Dublin) said that in Ireland there was great ignorance of aural surgery among practitioners. Dr. Barr (Glasgow) said that things were not much better in Scotland. Dr. Guye (Amsterdam) said that otology was likewise neglected in Holland.

Dr. Thomas Barr (Glasgow) then read a paper on

THE RELATION OF DISEASES OF THE NASAL PASSAGES AND NASO-PHARYNX TO AURAL AFFECTIONS.

He said that aurists were convinced more and more every day of the great significance of nasal and pharyngeal diseases in their relation to affections of the ear. Attention to the naso-pharyngeal cavity is looked upon as of the very first importance. Through the Eustachian tube the mucous surface of the middle ear and that of the pharynx are directly continuous; while by the same channel, under certain conditions, free interchange of air takes place between the two cavities. A large number of the diseases of the tympanum and mastoid cells are caused by simple propagation, along the mucous surface of the Eustachian tube, of catarrhal or inflammatory processes primarily affecting the lining of the pharyngeal cavity. Important changes in the structure and function of the tympanic apparatus may be brought about through occlusion of the Eustachian tube by the encroachment upon it of swollen, thickened, or hypertrophied tissue in the neighborhood.

The so-called adenoid vegetations consist of an exuberant growth or hypertrophy of this adenoid tissue, which Luschka has denominated the pharyngeal tonsil, a mass of glandular tissue, found chiefly in the roof of the pharynx, which also extends over the mouths of the Eustachian tubes. These vegetations, either tongue-shaped, globular, or flat excrescences, are found chiefly on the post-superior wall, from which they not infrequently extend to the posterior nares, where they interfere with the permeability of the nasal passages. The orifices of the Eustachian tubes are

often veiled by these masses, and in consequence, the ear is variously affected; sometimes we find purulent disease and sometimes simple catarrh.

The least painful, and probably the safest way of removing these growths, is to scrape them away with the nail of the index finger, a method introduced by Guye, of Amsterdam.

A discussion of this paper followed.

Dr. Guye (Amsterdam) said a few words respecting his instrument for closing the mouth and preventing mouth-breathing—he used it only as an aid to local treatment.

Dr. Loewenberg (Paris) thought that deafness was produced by adenoid growths, both by pressure on the Eustachian tubes directly, and by the production of inflammation in the naso-pharynx. He referred to the importance of rhinoscopy in these diseases.

Dr. Reeve (Toronto) had noticed that in cases of mucous polypi, the middle ear was not always affected because the mucous membrane was only affected locally.

Mr. Douglas Hemming believed that increased use of examination of these regions in almost all cases of deafness would reveal the existence of a much larger number of such cases than was generally supposed.

Mr. Cresswell Baber had found these cases of adenoid vegetations very common. In milder cases he scraped them with the finger-nail; in more marked cases, he used Calti's forceps and the galvano-cautery.

The Chairman had found much benefit from the use of tannin in these cases.

Thursday, August 11th.

Dr. Barr (Glasgow) proposed the following resolutions: "I. That a committee be appointed to consider and report, at the next annual meeting of the Association, on the best means of promoting the study of aural surgery, especially in regard to compulsory examination in this subject by the various examining bodies. II. That the committee consist of the chairman and honorary secretary of this subsection, and (with their consent) of all the teachers of

otology in the United Kingdom, with power to add to their number."

Mr. Cresswell Baber seconded the resolutions, which were adopted unanimously.

Dr. Thomas Barr (Glasgow) then read a paper on

THE TREATMENT OF PURULENT DISCHARGE FROM THE EAR WHERE THE SOURCE OF THE SECRETION IS IN THE UPPER PART OF THE TYMPANUM AND ANTRUM MASTOIDEUM—WITH FOUR ILLUSTRATIVE CASES.

The paper commenced with a description of the anatomical peculiarities and relations of the upper part of the tympanum and antrum mastoideum—the special symptoms and dangers which attended this form of suppuration of the ear, resulting from the anatomical peculiarities. Inflammatory products were apt to be retained in these parts, and it was very difficult to thoroughly cleanse them and apply medicated solution.

The method of treatment was then referred to, and the value of Siegle's suction-apparatus in aiding the clearing away of the purulent matter was pointed out. Then followed a description of the middle-ear syringe as used by the author, the method of cleansing, and disinfectant solutions most suitable. Repeated use of these solutions was necessary to remove the purulent and caseous débris. After this had been done, the best kind of application, in the opinion of the writer, was a strong solution of nitrate of silver, injected in small quantity by the middle-ear syringe. He then read the histories of four cases treated with benefit in this manner, and which had previously been ineffectively treated by aural specialists.

Dr. Jones (Chicago) considered that Dr. Barr had practically treated a practical subject. In these cases, besides using borated cotton, he had plugged with cotton containing iodine, and had found it very useful.

Dr. Jacob (Dublin) had treated cases in a manner very similar to that of Dr. Barr, and had found insufflation of boracic acid very useful. He gave much attention to the constitutional treatment, especially in young children.

Dr. Loewenberg (Paris) said that boracic acid was very useful in large perforations. He had somewhat modified Bezold's boracic acid treatment by combining with it the use of alcohol (absolute). He commenced with dilute alcohol, gradually increasing it up to full strength.

Dr. Ward Cousins (Southsea) used solutions of permanganate of potash, with good effect.

Dr. Guye (Amsterdam) observed that, in many cases of chronic and acute inflammation, perforation of the mastoid was necessary, and mentioned two cases in corroboration of this view.

Mr. Douglas Hemming (Bournemouth) had used wools impregnated with alum, boracic acid, etc., as introduced by Woakes, for treatment of the naso-pharynx. After syringing, cleansing, and drying the ear, he packed the cavity with wool, leaving it for some days, and then repeated the proceeding. He also spoke of perforation of the mastoid.

Dr. Loewenberg thought that incision of the mastoid bone should be avoided if possible.

Dr. Goodwillie (New York) described the method of performing the operation, and the form of drill he used.

The Chairman, in closing the discussion, said that, in cases where there was a great deal of muco-purulent discharge, the treatment should begin with lotions, and then the dry method may follow. He often combined thymol with alcohol, commencing with dilute solutions. Trephining was necessary in acute inflammation, where there was pus present in the mastoid cells.

EAR-PROTECTOR.

Dr. Ward Cousins (Southsea) exhibited and described his ear-protector, which is used to prevent the sudden access of great noises, of cold air, or cold water to the ear.

INSTRUMENTS.

Mr. Creswell Baber exhibited Politzer's small-hearing tubes, which he had used with success. Mr. Baber also showed his self-retaining nasal speculum and an improved aural scoop.

Dr. Jones (Chicago) exhibited an improved aural speculum, a modification of Brunton's.

Mr. Hodgson (Brighton) also exhibited a modification of Brunton's auriscope.

The Chairman, in closing the business of the Subsection, congratulated the members on the work, and the proceedings terminated with votes of thanks to the Chairman and Honorary Secretaries.—*The British Med. Journal*, September 3, 1881.

BOOK NOTICES.

UN TREDICESIMO NERVO CRANIALE. (A Thirteenth Cranial Nerve.) By D. GIUSEPPI SAPOLINI. Milan, 1881.

THE author of this interesting pamphlet introduces his subject by saying that Wrisberg was accustomed to tell his pupils: "Scient autem divitem naturam non facile exauriri posse." This, he says, is certainly true in regard to anatomy. Its extensive range, although searched through ages, still remains a fertile field for the discovery of new facts and for the breaking up of old and long-accepted ideas.

As a proof of this, the author adds that in 1777 Wrisberg brought to the notice of anatomists the "portio media inter communicantem faciëi et nervum auditorium." The priority of this discovery belongs, according to Scarpa, to Eustachius; but, Wrisberg having illustrated and described in detail the position and course of this filament, it consequently bears his name: intermediary nerve of Wrisberg.

Since then anatomists have been satisfied to repeat the statement and copy the illustration, with the exception of Scarpa, who, in 1789, asserts that it receives its origin in part from the groove between the seventh and eighth pair, and also from filaments of the ninth, or glosso-pharyngeus.

Sapolini, however, is convinced, from repeated anatomical investigations, that *the nerve discovered by Eustachius and Wrisberg is a part of the chorda tympani, which takes its origin from the fourth ventricle and terminates in the muscles of the tongue.*

In examining the floor of the fourth ventricle, in the triangular spaces to the right and left of the calamus scriptorius, it may be easily seen that there are a number of white filaments. These are either fine, undulated and numerous, or large, ribbon-shaped, and scant, and belong to the calamus. They are very prominent in some subjects, running first alongside and afterward above the level of the corpus restiforme, and are considered as roots of the acoustic nerve.

Another class of white filaments, although always present, cannot always be so readily observed. They are situated deeper in the gray lamellated stratum, which forms the floor of the fourth ventricle, and by patient and careful dissection they are easily brought to light. For a thorough examination of

these nerve-tracts we need a lens of two or three magnifying power; being very thin, their trace can easily be lost. This is more especially the case after the gray substance is removed, for then the fibres are embedded in a white mass, and, if once their path is lost, it is not easy to find it again. They are better seen in a piece macerated in diluted spiritus vini than in a fresh piece, although in the latter the gray color of the floor of the fourth ventricle shows to greater advantage the white color of the nerve-tract.

If we follow up one or more of these nerve-bundles, the ependyma covering them must be patiently and carefully removed, and, this done, the nerves themselves can be gently isolated, while every now and then during the process a drop of diluted spiritus vini is applied. In this manner it becomes easy to separate them from the surrounding nerve-elements, and they can be followed up, even when they seem to disappear or to be entirely absent. Acting on this principle, the author has been able to follow the nerve-bundles along the inferior part of the triangles, and hence, slowly descending, beyond the point of the calamus and underneath the lateral cords. As the same result was obtained in more than one subject, the idea of possible delusion can be excluded. The appearance is identical in children and in adults, but in the new-born they are often absent, and in general, at eighteen months, the white fibres are barely indicated; at thirty months and above they appear very distinct.

The author illustrates his discoveries by woodcuts made from photographs of anatomical preparations. In Figs. I. and II. these nerve-tracts can be seen and their course followed. Covered by a fine neuroglia, the filaments have a glistening appearance, which assists somewhat in the process of examination.

In Figs. I. and II. it is shown how the nerve-bundle (W) ascends and meets the roots of the acoustic nerve, and then passes under it (Fig. II., where W, or the Wrisberg nerve, passes under VIII., or the acoustic nerve). The author has not been able to ascertain whether at this crossing any anastomosis takes place, although in one of his preparations the filament could not be found again after running underneath the root of the eighth.

From this point the filament, cylindrical in form, bends outward and ascends, following the lateral margin of the fourth ventricle. When it arrives at the internal margin of the corpus restiforme, which already has curved itself to form the inferior peduncle of the cerebellum, the filament often disappears; but, with the assistance of the lens, it may be found again. The nerve-cord is embedded in soft and delicate tissue, and the best way to continue the examination is to separate it under the lens, with a cataract-needle, from the cerebral tissue which surrounds it, often applying a small drop of spiritus vini on the point where the needle has reached; this drop will penetrate half a millimetre or so between the smooth and glistening cord and the cerebral tissue, apparently separating them. It will be easily understood that a prog-

ress of a few millimetres will require considerable time; but, the more patiently we work, the better will be the chance of success.

The groove in which the nerve lies embedded becomes deeper and deeper. In order, therefore, to get both space and light, the margins of the groove must be separated, and then the nerve can be seen at the bottom of the groove. The nearer we approach the inferior lateral wall of the pons Varolii, the deeper the groove becomes. Then the pons Varolii is entered, and the nerve passes through it in an oblique direction from above downward and slightly backward. The end of this course always appears on a level superior to that of the large radix of the fifth, or trigeminus. The little nerve-cord follows distinctly its own course, and on the point of leaving the pons it bends slightly forward to join the trunk of the eighth. Between both nerves, however, lies a fold of the meninx, by which they are separated. Outside the pons, the nerve-tract, consisting generally of two filaments, will be found on a level, slightly higher than that of the eighth pair, and also higher than the posterior margin of the seventh, or facial. The color of the eighth pair appears whiter, and the nerve is also softer than the Wrisberg nerve. The latter is paler than the seventh pair, although both are of equal hardness.

Scarpa speaks of fine roots coming from the ninth or glosso-pharyngeal, and Barbarisi has given an illustration in which a large number of rootlets for the Wrisberg nerve come from the ninth. Sapolini, however, believed they could not be roots, but, at the utmost, anastomotical branches analogous to those between the tenth and seventh, or auricularis Arnoldi, between the ninth and seventh, or the ansa Halleri, or that between the seventh and the lingualis of the fifth. A very thorough examination proved, however, that the so-called roots are not at all nerve-elements, but blood-vessels. By pressure upon a large artery in the vicinity, they become red, and pale again when the pressure is relieved. A piece being removed and suspended in colored fluid, these "roots" became filled by capillary attraction. Moreover, a strong meningeal fold can be observed under the nerve-bundles of the seventh, eighth, and Wrisberg nerves, which separates these nerves from the ninth, and the latter nerve also runs on a level, lower and posterior to that of the others.

Situated close to the anterior margin of the eighth, the Wrisberg nerve ascends the inclined plane which leads to the meatus auditorius internus. It is, in addition to the neurilemma, enveloped in a fine neuroglia. An artery, derived from the acustica centralis, and described by Sapolini in "Annali Universali di Medicina, Vol. 229, Anno 1874," penetrates between the posterior margin of the Wrisberg nerve and the anterior margin of the eighth. In its further ascent, the nerve comes in contact with the seventh, which curves slightly backward in order to enter the meatus auditorius internus, together with the auditory nerve. But the nerve of Wrisberg does not unite with the seventh; both, surrounded by fine neuroglia, remain separate, and a rectilinear arteriole runs between them.

In this manner the nerve of Wrisberg passes on, and before it enters, with the facial, into the cavity where the ganglion geniculatum is situated, it sends off or receives two or three anastomoses from the eighth or acoustic, and none from the seventh or facial nerve. In the triangular recess of the ganglion the nerve appears slightly larger and thicker.

From the point where the Wrisberg nerve comes out of the pons Varolii to the ganglion geniculatum, it has a length of thirty millimetres, that is, eighteen from the pons to the lower edge of the porus acusticus internus, and twelve from there to the ganglion geniculatum.

At this point, the nerve first discovered by Eustachius, and subsequently illustrated by Wrisberg, terminates. Its beginning, according to their views, was at the external margin of the pons Varolii. The author having discovered a different origin much farther back, and characterizing the nerve as an independent nerve, endeavored, if possible, to detect its course through the ganglion.

The anatomical preparation of the ganglion is extremely difficult. It succeeds best when it has been immersed for three days in a solution of perchloride of iron (25 ad. 75 water), followed by maceration in diluted alcohol for twenty-four or thirty hours more.

In the illustration given by Professor Barbarisi of the ganglion geniculatum, there appear a series of nerve filaments, some in a higher level, others lower—all illustrated with such remarkable regularity, and so unlike what Sapolini found, that his skill must have been wonderful. Our author says, although his drawings cannot compare with those of Barbarisi, they have the advantage of being accurate, as they are made from photographs of anatomical preparations still in existence. There is no opportunity to compare the drawings of Barbarisi with any original preparation, since none exists in the Anatomical Museum at Naples, nor has any mention of it ever appeared in the catalogue of the museum.

In order to bring the ganglion geniculatum to view, the bony semicanalis Fallopii which encloses it must first be removed. It is then observed that the ganglion is covered on its upper part by a sort of cap of dense cellular tissue, which, from the presence of many blood-vessels, receives a reddish and somewhat punctated appearance. This cap can be removed by making an incision in the outer angle of the triangular ganglion, and if the incision be not too deep, its removal with fine pincers can be done without involving the underlying neurilemma, the direct covering of the ganglion. With equal care the neurilemma must be removed, but this is very difficult, as it sends off different septa between the component parts of the ganglion geniculatum. A number of preparations were made to dissect the ganglion, but they were generally unsuccessful, so far as the author's idea was concerned. As he expresses it: in this Medusa-head he lost the thread, and was obliged to desist.

His idea, however, had been from the first to decide whether or not this

nerve was connected with the chorda tympani, or the latter derived its origin from the Wrisberg nerve, or, perhaps, if it were not one and the same nerve. He therefore temporarily gave up following the Wrisberg nerve, and dissected the chorda tympani.

For this purpose the os mastoideum was cleft, so as to make the fissure at the outside of the hylo-mastoid foramen, running upward along the posterior bony wall of the meatus auditorius externus to a point nearly three millimetres from the highest part of the petrous bone. This being effected, it became easy to trace both the canalis Fallopii and the canaliculus which encloses the chorda. By the use of sharp pincers and scalpel the canal of Fallopius, which ascends from the hylo-mastoid foramen to the ganglion geniculatum, is opened, and at about three or five millimetres above the foramen we find the chorda tympani running at the side of the seventh nerve, and *apparently* originating from it. At first sight it seems as if the chorda came from a lower point and ascended, forming an acute angle with the facial. In this way it has been illustrated in Arnold's anatomical plates, and copied by Hirschfeld, Cruveilhier, and Sappey, who, as the author says, preferred copying to investigating. Guarini, who wrote under the auspices of Panizzo, gave an entirely different description.

If the facial nerve be denuded of its cellular covering without removing it out of its canal, we can see the egress of the nerve-bundle, the chorda tympani. It does *not* come from below, but from above; descends from the facial nerve, but is *not* derived from it. In this descent an angle is formed between the two, but the sides of the angle meet upward, not below, as was heretofore illustrated. The chorda tympani comes from the centre of the nerve-bundle of the facial nerve, and descends, penetrating an osseous canal. It is surrounded by cellular tissue. After having run for two or three millimetres it forms itself into a loop, with the concavity upward. From the point where the chorda separates itself from the facial to the point where the greatest declivity occurs, it measures two and a half millimetres (Fig. III.).

Another preparation (Fig. IV.), from a new-born subject, in which the mastoid cells are not yet developed, shows also the same relation between the facial nerve and the chorda tympani, and, considered in connection with the development of the os mastoideum and the lengthening of the canalis Fallopii, may help to explain the curvature of the nerve.

With the chorda tympani as a guide, we now can penetrate the nerve-bundles of the seventh pair ascending in the Fallopian canal. If the preparation has been exposed for a long time to maceration in spiritus vini, the chorda appears somewhat darker than the facial nerve, and has less consistency. Surrounded by its neurilemma, the chorda winds its way upward between the bundles of the facial nerve in the Fallopian canal; it remains at the periphery of the nerve and carries in its neuroglia a thin rectilinear artery.

When the nerve has reached the horizontal part of the Fallopian canal, it runs toward the ganglion geniculatum. After its entrance into the ganglion it becomes softer than before, and it occupies the middle part. In its course the chorda does not send or receive any anastomosis from the seventh, from the petros. superfic. maj. or min.; while in the ganglion, the chorda, by a slight inward curve, forms a small angle and appears somewhat larger and swollen, exhibiting sometimes a small furrow in its longitudinal direction. In this part of the ganglion we find the chorda uniting itself with the Wrisberg nerve, the further investigation of which was discontinued, as before stated, or, as the author would say, it is sufficiently proved that the Wrisberg nerve and the chorda tympani are in reality but one nerve, deriving its origin from the fourth ventricle, passing through the ganglion geniculatum, and ending in the smallest ramifications of the chorda tympani.

The author thinks it would be right to give this nerve a special name. He objects to the name of Wrisberg nerve, since Wrisberg only described the short track from the pons Varolii to the ganglion geniculatum. Neither would he accept the name of chorda tympani, because it does not leave a single branch in the tympanic cavity, though passing right through it. He calls the nerve a complete cerebral nerve, and as in the order of their local appearance the facial nerve is the seventh, this one should be the eighth, the acusticus the ninth, and so on, so that the nervus hypoglossus would become the thirteenth.

He now continues the examination of the chorda tympani after it has left the Fallopian canal and the seventh. Having formed the curve or loop before mentioned, it runs a distance of fourteen millimetres in a bony canaliculus, then bends forward and runs through a part of a compact bony mass (the end of which projects in the tympanic cavity as the pyramid), and enters the tympanic cavity at its outer wall, near the margin of the membrana tympani, connects with the long process of the incus and the neck of the malleus, but without forming any trochlea, as has been stated by some observers. In its course through the cavum tympani, five and a half millimetres long, it is somewhat in the form of a festoon, always covered by the mucosa of the tympanic cavity and accompanied by a small artery. No branches are sent off for the innervation of the membrana tympani. It then enters a canal situated behind the lig. mallei posticum. After a short course, it passes through an opening in this canal, and not through the fissura Glaseri articulation, and descends, running free, slightly at the inside of the temporo-maxillary. From its exit through the foramen to the point where the chorda meets the lingual branch of the fifth, it measures thirty-seven millimetres.

At first sight it would appear as if the chorda and the lingual nerve were united to one trunk, surrounded by a strong neurilemma. After this has been removed, each nerve, however, is found with its distinct neurilemma, and their junction is indicated by a small anastomotical branch, which goes from

the chorda to the lingualis, or the reverse. After this first anastomosis frequent interchanges take place between both nerves. For a distance of thirty-four millimetres these nerves run side by side, and then penetrate the muscular tissue of the tongue, and here they form a complicated net of anastomoses. This net the author calls plexus tympano-lingualis.

In this plexus, however, the lingual branch of the fifth runs more in the upper part of the tongue, near its surface, while the chorda runs from one muscle to the other, and its frequent subdivisions supply the fibres of these muscles. Although there are but few distinguishing features between the two nerves, it is obvious that in the fresh cadaver the color of the chorda is slightly darker than that of the lingualis, somewhat yellowish, and this same color is found in all its ramifications. Its tissue is at the same time somewhat more compact, hence, of greater resistance to the touch than that of the lingualis. From the last point of measurement to the extremity of the tongue, or from the beginning to the end of the plexus tympano-lingualis, it measures about seventy millimetres.

Fig. VI. in the monograph gives a profile sketch of the entire tract of the thirteenth nerve, with the measure of its different subdivisions. These measures are as follows:

Millimetres: 33. From the calamus to the point where the nerve-cylinder leaves the plane of the ventriculus quartus.
" 15. From the latter point to the inferior and external side of pons Varolii.
" 30. From the pons to the entrance in the ganglion geniculatum.
" 6. Its measure within the ganglion.
" 17. From the ganglion geniculatum to the point where it seems to leave the bundles of the facial nerve, being also the lowest part of the loop formed by the chorda tympani.
" 14. From the lower point of the loop to the entrance of the chorda in the hard, bony mass which forms the pyramid.
" 2. Its short course through part of this mass.
" 9. Course of the nerve in the tympanum, from its exit from this mass to its entrance in another opening in the anterior part of the cavity.
" 37. From the latter point to its junction with the lingual nerve of the fifth pair.
" 34. From this junction to the beginning of the plexus tympana-lingualis.
" 70. From this to the apex of the tongue.

A length of 267 millimetres.

To complete the description of this thirteenth nerve, it must be stated that a few weak nerve-fibres pass from the chorda to the ganglion and glandula submaxillaris—too small in number to make it probable that the only function of the chorda should be the innervation of this ganglion and gland. In Fig. VII. the plexus tympano-lingualis is shown in the tongue, and here are found a few thin fibres from the ninth or glosso-pharyngeal nerve connecting with the plexus.

The author thinks that, from its origin in the corpora restiformia and the lateral chords, the nerve must possess both sensitive and motor fibres. After its exit from the triangle of the calamus scriptorius it runs in the floor of the fourth ventricle in the gray stratum, which is the continuation of the central gray matter of the spinal cord. And as all roots of the spinal motor and sensitive nerves originate in this gray matter, the thirteenth cerebral nerve must have identical qualities.

The nerve continues its course, now visible to the unaided eye, now buried in the tissues of the pons Varolii, in close proximity to the eighth, and before it leaves the pons. Some anastomoses are found between the two nerves. After its exit from the pons, it apparently divides in two filaments, running upward with the eighth and seventh pair to the meatus acusticus internus, and here again is an anastomosis between the thirteenth and the eighth.

Within the ganglion geniculatum it neither gives nor receives any branches. It descends with the seventh through the Fallopian canal, and separates itself from the latter to ascend again under the name of chorda tympani; it then goes to the cavum tympani, which it leaves again to meet the lingual branch of the fifth nerve. From the ganglion geniculatum to the latter point no anastomoses could be found.

The filaments coming from the thirteenth nerve dissolve themselves in the lingual muscles, and their number surpasses by far that of the lingual nerve, which moreover supplies especially the superficial tissues of the tongue. But the ramifications of the thirteenth (as Fig. VII., the reproduction of a photograph, shows) spread into the intrinsic muscles of the tongue, longitudinalis, inferior, profundus, superficialis—in fact, in all of them.

Surprised at the large number of fibres from the thirteenth in these muscles, the author came to the conclusion that certainly their mission must be a special one. He believes that the lingualis of the fifth, and its anastomoses with the glosso-pharyngeal nerve, give to the tongue sensibility, both as to touch and taste; the extensive movements of the tongue, as in deglutition, may depend upon the twelfth or hypoglossus and the lingualis of the seventh pair.

What then, he asks, may be the special *raison d'être* for the thirteenth nerve? Given the voice, the sound, it has to be formed into letters, and further, words or speech. We cannot form a vowel without a movement of the tongue, and in no way can consonants be accented without special and simul-

taneous contraction of one or more of the intrinsic muscles of the tongue. Sapolini believes that this is the special action of the thirteenth nerve.

When the child begins to articulate, the monosyllable or the word which it attempts to pronounce begins with the vowel a or o, which require the least motion of the tongue. The slow progress in articulation the author believes to correspond with the late manifestation of the white nerve-filaments, which subsequently appear on the floor of the fourth ventricle.

There are mutes who can hear well, and the author himself has seen three cases, which he cites, where hearing was more or less normal, but no words could be emitted, only sounds. He believes that in these cases the thirteenth nerve was defective, from some arrest in development. The acoustic nerve and the thirteenth may be interrupted and separated along their entire course, or the centrifugal fibres of the nerve may not connect with the centripetal trunk from the tongue to the brain.

Four years ago, at the Congress of Geneva, the author presented a table of deaf-mutism. In this table a distinction was made between *deaf-mutes* and *deaf* not *mutes*, and *mutes* not *deaf*, while for the latter there is a subgenus: balbuties. This table is repeated at the end of the pamphlet. The family of deaf-mutes is divided into two genera : I. Deaf-mutes, with subgenus A, deaf not mutes; and II. Mutes not deaf, with subgenus B, stammering. From A are excluded all cases where deafness resulted later in life, but all cases were admitted where it resulted from sickness in early life before the seventh year.

Speech, the author says, belongs exclusively to the genus homo ; but, with patience and perseverance, we can teach a parrot to talk. As in other birds, there is a chorda tympani in the parrot, and by cutting the chorda in two talking parrots, he made them mute. This cutting of the chorda, he observes, is extremely difficult, but at dissection, made several months later, the nerve-ends were found severed.

Two pathological cases are mentioned. In the first, a woman had received a heavy blow on the right temple ; the hearing on that side was greatly diminished, and on that same side the tongue became inert in its movements, and speech was impeded ; but the seventh was intact, the lingualis sensible, and taste on that side remained. The second case, a girl, aged eleven, came to the author's aural clinic. A large ulcer existed on that portion of the temple where the superior part of the meatus acusticus joins the left zygoma. The ulcer was deep, and the probe penetrated four to five millimetres in the bone, which was somewhat spongy, and some necrosed spiculæ could be removed. She visited the author at long intervals. One day her mother told him she had discovered that the girl could not speak, or rather, that she articulated with great difficulty, and, as it appeared to him, with increased efforts from the healthy side. She remained in this condition for several months, although the ulcer had entirely healed. The author believes that the canaliculus chordæ had been involved in the process of suppuration and had become eroded.

The tongue moved sluggishly, but the hypoglossus and the lingualis of the seventh were active, and on the affected side there was both taste and sensitiveness to touch; hence, the lingualis of the fifth and ninth performed their function. The only nerve affected was the thirteenth, or the chorda tympani.

The author believes that in balbuties there is an affection of the chorda in connection with the twelfth.

At the end of his pamphlet the author offers the following physiological suggestions: The nerve-cord of the thirteenth, after having entered the pons Varolii, forms an anastomosis with the eighth; another anastomosis with the same nerve takes place before the thirteenth enters the ganglion geniculatum. These anastomoses are especially with the cochlear branch of the eighth. From that point the thirteenth does not give or receive any anastomoses until in the buccal cavity it meets the lingual branch of the fifth. The parrot, the child, and ourselves hear a sound, a word; through the membrana tympani and membrana rotunda it is then transmitted to the cochlea, and hence to the sensitive nerve-centre. If we wish to repeat this word or that sound, it is the chorda tympani which does the work; and, in the author's opinion, the formation of words depends really and solely upon this nerve.

From the nature of the communication and the importance of the facts proposed, the reviewer believes he may be justified in that this review has taken almost the form of a translation of Sapolini's article. Its importance, both for anatomy and physiology, if confirmed by further researches, cannot be denied. A new pair of cerebral nerves added to the twelve already known; the portio intermedia of Wrisberg not a root of the facial, but a part of an independent nerve, continuing in the chorda tympani; the chorda tympani not a branch of the facial nerve, and, although coursing together for a long distance in the same path, never forming an anastomosis with the facial; its chief duty the innervation of the intrinsic muscles of the tongue, and not merely for the ganglion and glandula submaxillaris; the chorda tympani not a nerve of taste, but a nerve of speech, a prominent factor in the formation of words—are all points entirely unlike that which has hitherto been taught, and it can but lead to the fulfilment of the author's earnest desire that his investigations may be repeated, and others also become convinced. And of special interest the question becomes to otologists, for the nerve-branch, hitherto considered as having no connection with the organ of their specialty, except the anatomical fact of its course through the tympanic cavity, becomes, if our author's views are correct, an important factor for speech. The anastomosis between the Wrisberg nerve and the eighth in the meatus was known long since (Hyrtl), and in Gray's "Anatomy" the origin of the nerve is stated to be at the lateral column of the cord. But in both the chorda tympani is described as a branch of the facial nerve. C. H. Burnett calls the chorda a branch of the seventh, and remarks it has no connection whatever with the

auditory nerve. Roosa follows entirely the anatomical description of Gray, and says its anatomy seems to indicate that it has very little to do with the function of hearing. It merely passes through the tympanum without supplying any of its tissues. Von Tröltsch writes that the chorda tympani, although running by the outer wall of the tympanic cavity, can only be considered as passing through it. Urbantschitsch merely mentions its anatomical appearance, while in Politzer no reference at all is made to it. Flint ("Text-Book of Human Physiology," p. 622) says, in regard to the union between the chorda and the lingualis of the fifth, it has been a question whether the chorda were simply enclosed in the sheath of the lingual branch of the fifth, or so closely connected with it that it cannot be traced to a distinct distribution. Upon this point he is disposed to adopt the opinion of Sappey, who, as the result of minute dissections, regards the union as complete, "fibril to fibril"—a marked difference from what Sapolini claims to have found. Also that, as regards the portion of the facial which furnishes the filaments of the chorda tympani, it is impossible to determine anatomically whether these come from the main root or from the intermediary nerve of Wrisberg, as the fibres of these roots are closely united before the chorda tympani is given off. This is another point upon which the author claims to have thrown more light. As regards the function of the chorda, it is, according to Flint, a nerve of taste, and the clinical cases which he records certainly point in that direction. But in Sapolini's cases no such result followed. It must be confessed that Sapolini's discoveries and his physiological deductions are, to say the least, very attractive, and that his explanation seems more natural than the one which now prevails, and which assigns to the chorda tympani, as a branch of the facial nerve, a function entirely different from that of all its other branches.

J. J. B. V.

HABITUAL MOUTH-BREATHING; ITS CAUSES, EFFECTS, AND TREATMENT. By CLINTON WAGNER, M.D. Pp. 52. G. P. Putnam's Sons, New York, 1881.

THIS little book comprises a paper read by the author before the Medical Society of the County of New York, together with the discussion thereon. The author draws attention to the perniciousness of the practice of breathing habitually through the mouth, and gives the causes—carelessness, and local nasal and mouth troubles. In adducing reasons for the naturalness of nose-breathing, he brings forward the fact that infants are unable to breathe otherwise, else the act of sucking could not be performed; that in health they almost always sleep with the mouth closed, the tongue lying in contact with the hard palate, the mouth taking no part as an air-passage. Dr. Wagner, in a considerable experience among the Indians of the North American frontier, arrived at the conclusion that they were quite free of affections of the nose, throat, and ear, although much exposed to the inclemencies of a se-

vere climate; this exemption he believes to be owing to the practice of nose-breathing, which they are supposed to universally practice.

Referring to mouth-breathing from closure of the nasal passages, the author believes that it unquestionably causes impairment of hearing; but he maintains, notwithstanding, that non-nasal respiration is not necessarily, *per se*, a cause of this condition. In proof of this, he states that air can freely enter the tympanic cavity, even when the nasal passages are closed. This latter statement is undeniably true, but the author overlooks the fact that there is a wide difference between the possibility of passing air forcibly into the tympanum and its normal renewal with every act of respiration; in the former instance some air passes up through the Eustachian tube during the act of swallowing, which may be of quite infrequent occurrence, while in the latter a constant supply is afforded. Non-nasal respiration, during the developmental period, cannot fail to impair the hearing in every instance.

The author is an advocate of the prompt removal of the tonsils when they prevent nasal respiration; and he advises the employment of the syringe, and sniffing fluids up the nose, for the purpose of softening and detaching the hardened secretions covering the turbinated bones and septum, and filling the lower meati. It may be doubted if mothers and nurses can thus cleanse the Schneiderian membrane covering the turbinated bones, although they might in a measure cleanse the lower meati. The author recommends that children be taught to use the mouth for eating and speaking only, and that during sleep those in charge of them should keep the lips pressed together. This would no doubt effectually ensure nasal respiration, but we may be permitted to hesitate in advising our patients to inaugurate so thorough a plan of treatment. When children are exercising actively, it would be found very difficult to enforce constant closure of the mouth, and very few mothers or nurses could be induced to keep an infant's mouth constantly closed during the sleeping hours; and when awake, much of the child's time is occupied in laughing and crying. It seems to the reviewer that in health these matters regulate themselves to a great extent, and that when disease is a cause, the habit cannot be entirely avoided until the patient has been cured.

The treatment recommended for the affections, and they are many, which give rise to the difficulty under discussion, is entirely surgical; not a single word is devoted to internal medication. This is much to be regretted, for the therapy of medicine is now undergoing significant changes, and from those who are engaged in treating diseases covering so wide a field as does laryngology we have a right to expect some manifestation of their interest in this subject. The surgical treatment of the author does not differ widely from that of others; he praises one operation, however, that does not seem to be based on tenable ground, namely, the destruction of the mucous membrane covering the inferior turbinated bones when it is "much relaxed, œdematous, and presents the appearance of a gelatinous or mucous polypus,"

by the employment of the galvano-cautery. One fails to understand how the author can destroy a membrane distributed over a surface so extensive, and that without pain; and what advantage it would be to a patient to be deprived of this useful structure. And moreover, what assurance can be given that the bone may not be entirely denuded in places, in an operation where the surgeon cannot see what his white-heated platinum wire is doing?

G. B.

REVIEWS.

Researches upon Resultant Tones (*Recherches sur les Sons Résultants*). By M. L. Nicotra: *Journal de Physique*, January, 1881.—Resultant tones may be obtained with sounds which are successive rather than simultaneous, owing to the persistence of sensation, the sound having its origin in the ear itself, and being purely subjective. The instruments used in demonstrating this fact were organ-pipes and a loud-toned harmonium.

The author remarks that the differentials of the first order are often very weak compared with those of higher orders. Thus, the interval of the major seventh $ut_2—si_2$ (8 : 15) gives as its most distinct resultant sol_1 (6), which is a differential sound of the third order. (15—8=7; 8—7=1; 7—1=6.) Also the minor seventh, $re_2—ut_3$ (9—16), gives a resultant ut_4 (2), which is a differentiate of the second order (16—9=7; 9—7=2). This result might also arise from the concurrence of ut_3 with the first over-tone of re_2.

The author finds that occasionally summation-tones are noticed, caused by the concurrence of the first differential with one of the primaries.

The resultant of a simple consonance may be greatly enfeebled or entirely obliterated if an additional consonant-note is added.

It seems desirable to the writer of this abstract that M. Nicotra's experiments should be repeated, using sounds less strong in over-tones than those produced by harmonium reeds. The nature of the organ-pipes used is not stated in the article. C. R. C.

Vibrations of Circular and Elliptical Plates. F. E. Cabot: *Proceedings of American Academy*, Vol. XV., p. 219.—The author has studied the effects of change of ellipticity of a plate upon the position of the nodal lines. Seven plates were used in the experiments, with results which the author sums up as follows:

First.—Certain fundamental vibrations of elliptical plates are not changed by wide variations in the ellipticity of the plates.

Second.—The vibrations of elliptical plates are less varied than those of circular plates. A small amount of ellipticity results in a quick and marked limitation in the variety of the vibrations of the plate.

Third.—It is to be conjectured, therefore, that an animal whose ear is provided with an elliptical shaped membrane, if such an animal exists, has less perfect powers of hearing than one provided with a circular membrane, as far as the variety of vibration of the membranes are considered. C.

Perforated Vibrating Discs. F. E. Cabot: *Proceedings of American Academy*, Vol. XV., p. 222.—Experiments were tried to ascertain the effect of removing a portion of the iron from an ordinary telephone-disc. It was found that nearly a third of the plate could be removed without seriously impairing the articulation, the portions cut away being replaced by paper. Also a disc of iron three-fourths of an inch in diameter, attached to a disc of mica two and one half inches in diameter, if substituted for an ordinary telephone-disc, will produce good articulation over a short line.

On Radiophony (*Sur la Radiophone*). Second Memoir. By M. E. Mercadier: *Journal de Physique*, April, 1881.—The author uses as a radiophonic receiver a tube partly covered with lampblack on its interior. The end of the tube communicates with the ear by a hearing-tube of rubber. A clear sound is heard only when the intermittent radiations fall on the lampblacked portion. If the exterior alone is blackened, no audible effect is produced. From a variety of experiments of this nature the author concludes that the vibration is produced by the layer of air in contact with the walls of the receiver.

The mechanism of the transformation is as follows: the layer of air condensed on the walls of the receivers is alternately heated and cooled by the intermittent radiations, and from this result periodical and regular expansions and contractions, so that a vibratory motion is communicated to neighboring gaseous layers, which may also vibrate directly under the same influence.

If a tube with a portion of its interior blackened has one end closed by a movable piston and the other end open, the intermittent radiations cause vibrations of the air in contact with the lampblack. If the length of the tube is such that the air contained can vibrate in sympathy with these, it will respond. Hence, with a fixed rate of the interrupting wheel, the intensity of the sound will vary, alternately increasing and diminishing as the piston is moved so as to vary the length of the column of air. The positions of successive nodes and loops can easily be found thus, and the experiments of Dulay relative to the determination of the velocity of sound in any gas may be repeated. The method will, perhaps, furnish an improvement on that originally used by Dulay, as it is easy to keep the gas at any desired temperature and pressure, and there is no disturbance such as is produced by the embouchure in the older method.

The latter part of the memoir describes the study of the vibrations excited in gases, the result being similar to those obtained by Tyndall.

Third Memoir. *Journal de Physique*, June, 1881.—The author describes a form of radiophonic transmitter and receiver by which he has transmitted speech. The general principle of the apparatus is the same as that invented by Professor Bell, and already referred to in this journal. In order to prevent

the danger of breaking the silvered glass (which is used in the same manner as in the selenium photophone of Bell), a membrane is stretched across the air-cavity of the transmitter, so as to divide it into two portions. The voice thus acts upon the mirror only through the motion communicated to the membrane. For a receiver Mercadier uses a glass tube containing a slip of blackened mica, and the glass tube is closed at one end, and is furnished with a rubber hearing-tube. A lens is used to concentrate the rays on the receiver. Speech has been transmitted not only by the use of sunlight, but also for a short distance by using the lime-light.

An article by Mercadier, on the same subject, will also be found in the *Comptes Rendus*, May 23, 1881.

C.

RADIOPHONY. W. H. PREECE. Paper read before Society of Telegraph Engineers. Abstract in *Telegraphic Journal*, June 1, 1881.—Mr. Preece disagrees with Professor Bell as to the cause of the sounds in the radiophone, still thinking that the vibrations of the confined air, rather than those of the disc, are the effective agents. He does not deny that vibrations of the discs occur, but thinks that the sounds actually heard are produced in the manner described in his previous paper. This view of the case he sustains by Mercadier's experiments, in which a cracked disc proved as efficient as a whole one, and also by the fact that the *timbre* of the sound produced is independent of the material of the disc. If the disc is replaced by a sheet of glass, the sounds are good; but if the glass is slightly moved so that the chamber into which the rays fall is slightly open, the air is unconfined, and the sounds cease.

C.

UPON A MODIFICATION OF WHEATSTONE'S MICROPHONE AND ITS APPLICABILITY TO RADIOPHONIC RESEARCHES. By ALEXANDER GRAHAM BELL: *Silliman's Journal*, August, 1881.—Mr. Bell first describes an experiment showing the probable source of Mr. Preece's error in supposing that the disc of the radiophone does not vibrate. He then describes a modification of an apparatus, devised by Wheatstone, in 1827, by which he has investigated the motions of the disc. It consists of a stiff wire, one end of which is rigidly attached to the centre of a metallic diaphragm. The wire passes through a perforated tube, used as a handle, so as to be exposed only at the extremity. The diaphragm is mounted in the same manner as an ordinary telephone plate, and furnished with a rubber hearing-tube. On exploring the disc of the radiophone with this instrument the most conclusive evidence of vibration was obtained.

C.

VELOCITY OF SOUND IN CHLORINE. MARTINI: Abstract in *Nature*, May 19, 1881.—The velocity of sound in chlorine has been determined by Professor Martini, by ascertaining the length of a tube filled with the gas and closed at one end, which gives a maximum resonance to a particular note. The value found is 206.4 m. at 0° C.

C.

Resonance of Mouth-Cavity. J. Naylor: *Nature*, June 2 and 9, 1881. Mr. John Naylor, in two letters to *Nature*, calls attention to some curious effects of the resonance of the mouth-cavity. While riding on the cars he found himself able to hum a tune by the simple change of the form of the cavity, as in whistling, the note to which the cavity could resound being selected from the noise of the cars and strengthened. Also the upper partials of reeds, organ-pipes, and the voice were observed to be strengthened in the same manner, so that they were even audible to a second person. If the upper partials strengthened are near together, beats are heard. In later experiments, Mr. Naylor succeeded in analyzing various compound tones, as, for example, those of a clarinet organ-pipe, with which the odd over-tones were very strong, the even ones weak.

C.

Lissajou's Curves.—In the *Journal de Physique* for June, 1881, Crova describes an ingenious method by which the phase of Lissajou's curves can be raised at will within certain limits. His method depends upon the fact that if a powerful magnet is brought close to a vibrating tuning-fork, the attractive force thus developed increases the period of vibration, acting in the same manner as a supplementary weight attached to the prongs. A movable electro-magnet is used, whose position can be adjusted. The forks are arranged to run automatically by electricity, without variation of phase, and the electro-magnet on being excited causes an alteration in phase.

A simpler method by which Lissajou's curves may be shown and the interval caused to vary progressively, is described by Trowbridge in the *Proceedings of the American Academy of Arts and Sciences* for 1880 (Vol. XV.). Two wires stretched at right angles are kept in vibration by electro-magnets. To each wire a mirror is attached, so that the latter vibrates with the wire. A beam of light is reflected successively from the two mirrors. The mirrors are steadied by flexible brass strips, and the tension of the wires can be varied by means of a key.

C.

Acoustic Apparatus for Use in the Class-Room (*Ein Akustischer Apparat zu Vorlesungszwecken*). H. Maschke: *Wiedemann's Annalen*, No. 5, 1881.—The apparatus described is intended to demonstrate the position of the nodes and loops of a column of air, either open, or closed at one end. A glass tube rests upon a horizontal support, and within the tube slides a rod, at the end of which is placed a small vertical membrane formed by stretching a film of collodion over a ring. Upon this membrane, and just touching it, rests a bit of sealing-wax suspended by a filament of cocoon-silk. Arrangements for adjustment are attached to the apparatus. The air within the glass tube is caused to vibrate by a tuning-fork of proper pitch. On moving the membrane along the axis of the tube the globule of sealing-wax is set in motion by the vibration of the membrane, unless this is at a node. By placing the appa-

ratus in front of the condensing-lens of a lantern, the membrane and wax ball can be projected upon a screen, and the phenomenon shown to a large audience. C.

Further Contributions to the Neuropathic Form of Ménière's Disease. J. Gottstein: *Archiv für Ohrenheilkunde*, Vol. XVII., p. 174.—By neuropathic forms of Ménière's disease, Gottstein would include those cases of aural vertigo the cause of which lies in a disease of the auditory nerve, either along its trunk or in the terminal fibres within the labyrinth, and when disease of the conducting mechanism can be distinctly excluded. He considers that the majority of cases which present the symptoms of the primary otitis labyrinthica of Voltolini are in reality secondary, and usually the results of meningitis cerebrospinalis, the symptoms of the meningitis being often overlooked, owing to the peculiar course of the disease. To uphold this position, Gottstein assumes an abortive form of cerebro-spinal meningitis, which, as it is never fatal, cannot be confirmed by autopsy, but is acknowledged by Eulenberg and others who have seen much of the disease. And again, he says that many cases of the so-called otitis labyrinthica present the clinical picture of a mild cerebro-spinal meningitis, and the strongest point of all, that they occur during epidemics of that disease. He shows by his statistics that in places, and at the time when cerebro-spinal meningitis was epidemic, so-called otitis labyrinthica was frequent, and as the epidemic diminished, the cases of this aural disease diminished.

It is well known that in these cases other nerves may be and often are affected besides the auditory, and that mild symptoms of meningitis are present. Gottstein asserts that in *all* such cases which he has examined, the meningitic symptoms, although perhaps slight, have always preceded the auditory symptoms. He narrates a case in which the abducens, oculo-motorius, and trigeminus, and finally the acusticus, were affected, and another where the symptoms were almost entirely those of otitis labyrinthica followed by deafness and disturbances of equilibrium, and yet idiocy was also the result.

From these observations Gottstein is inclined to doubt more and more whether there is a real primary otitis labyrinthica.

Gunshot Wound of the Ear, with Loss of Liquor Cerebrospinalis. R. Koerner: *Archiv für Ohrenheilkunde*, Vol. XVII., p. 195.—The bullet from a revolver, 9 mm. in calibre, entered just behind the meatus into the bone through the right auricle, and embedded itself in the lower and posterior part of the tympanum, close to the mastoid antrum. The only symptoms were vertigo and a tendency to walk in a circle; no pain in the head, nausea, or vomiting, or paralysis. A clear, transparent, watery fluid, tinged with blood, flowed from the wound, by measurement two cubic centimetres, in fifteen minutes, and was considered to be liquor cerebrospinalis. Three days after-

ward there was severe headache behind the right ear and in the occiput; much relieved by leeches. Five days after injury the discharge, which was never purulent, began to diminish, and in three days more had ceased entirely, although vertigo continued for some days longer. The hearing of the ear was lost immediately, and never improved. No attempt was made to remove the bullet.

The probable diagnosis was a fracture of the osseous and a rupture of the membranous labyrinth, which, from its communication with the arachnoid cavity, produced the abundant serous fluid and gave rise to the uncertain gait from injury to the semicircular canals.

Report of the Polyclinic for Ear Diseases for 1880. K. Bürkner, Göttingen: *Archiv für Ohrenheilkunde*, Vol. XVII., p. 181.—Whole number of patients, 428, with 467 forms of disease; 43 were not treated, and in 8 no diagnosis was made. Of these were

Cured	179,	or 42.00	per cent.
Improved	81	" 19.1	"
Unimproved	22	" 5.13	"
Not treated	43	" 10.03	"
Treatment unfinished	72	" 16.5	"
Died	1	" 0.24	"
Remaining under treatment	30	" 7.00	"
	428	100	

Diseases of external ear	115;	right, 22;	left, 41;	bilateral, 52
" membrana tympani	12	" 1	" 10	" 1
" tympanum	252	" 49	" 55	" 148
" inner ear	28	" 1	" 1	" 26
Diverse	21	" 1	" 1	" 11
	428	74	108	238

Males, 271, or 63.5 per cent.

Females, 157, or 36.5 per cent.

BIBLIOGRAPHICAL INDEX.

Books.

"A Method of Teaching the Deaf and Dumb Speech, Lip-Reading, and Language." T. Arnold. Royal 8vo. London, 1881.

"A Manual of Diseases of the Eye and Ear, for the Use of Students and Practitioners." W. F. Mittendorf. 8vo, pp. 445. New York, 1881.

"Lehrbuch der Ohrenheilkunde mit Einschluss der Anatomie des Ohres." Von Tröltsch. 7. Aufl., 8vo. Leipzig, 1881.

Journals.

External Ear.

"Polipos Auriculares," Ariza: Siglo Méd., XXVIII., 309, 324, Madrid, 1881.

"Syringing the Ear," Anonymous: Atlanta Medical and Surgical Journal, July, 1881.

"Cauterization of the Helix of the Ear," Anonymous: Schmidt's Jahrb., II., 1881; Chicago Medical Review, August 20, 1881.

"Diffuse Inflammation of the External Auditory Canal," E. C. Baber: British Medical Journal, July 9, 1881.

"Pea in the Ear for Two Years without Irritation," T. Barr: Glasgow Med. Jour., XV., 391, 1881.

"Die Erkrankungen des Zitzenfortsatses und ihre Beziehungen zum Gehörorgane," A. Bing: Habilitations-Vortrag, Wien Med. Bl., IV., 421, 425, 486, 1881.

"Primäres Myxom des Linken Vorhofs," E. Bostroem: Sitsungsb. d. phys.-med. Soc. in Erlang., XII., 163, 1879–80.

"Fibrome in Folge von Ohrringen," M. Buch: St. Petersburg med. Wochsch., August 1, 1881.

"Fibromi Koji vsliedstrie noshenija serege" (Tumor of Auricle), M. Buch: Vrach, St. Petersburg, II., 426, 1881.

"Etiology of Aural Exostosis," Cassells: New York Medical Record, Sept. 17, 1881; London Medical Times and Gazette, Aug. 27, 1881.

"Sulla degenerazione calcare dell' anello timpanico," G. Ciniselli: Morgagni, XXIII., 214, Napoli, 1881.

"Death after Several Years, from a Spider in the Ear." E. A. N.: San. News, I., 38, Hamilton, O., 1881-82.

"Haut-Transplantation bei chronischer Eiterung des Mittelorhres," E. T. Ely (Uebersetzt von H. Steinbrügge): Ztschr. f. Ohrenh., X., 146, Wiesb., 1881.

"Removal of a Foreign Body by Disarticulation of the Auricle," J. Orne Green: New York Medical Record, Aug. 20, 1881; Trans. American Otol. Soc., 1881.

"Desquamative Inflammation of the Ear," J. Orne Green: Boston Med. and Surg. Jour., July 21, 1881.

"Épithéliôme Calcifié du Lobule de l'Oreille," Heurtaux: Bull. Soc. Anat. de Nantes, 1879, 4°, Paris, 1880.

"Otite Suppurée; Hémiplégie Faciale," Josso: Bull. Soc. Anat. de Nantes, 1879, Paris, 1880.

"Treatment of Eczema of the Ear," H. Knapp: Arch. Otol., IX., 4.

"Mound-Builders' Skulls," H. Knapp: M. Times and Gazette, Aug. 28, 1881.

"Le Furoncle de l'Oreille et la Furunculose; Rôle des Microtes sans ces Affections; Applications Thérapeutiques," Loewenburg: Progrès Méd., IX., 513, Paris, 1881.

"Case of Malformation of the External Ear," P. McBride: Edinburgh Med. Jour., XXVI., 905, 1880-81.

"Case of Eczema (Lupoid) of the External Meatus," F. M. Pierce: Specialist, I., 141, London, 1880-81.

"Pulsatiën aan het Trommelvlies," J. Schoondermark: Gencsk. Courant, No. 10, Tiel, 1881.

"On the Extraction of Foreign Bodies from the Ear," J. M. Sims: British Med. Jour., Dec. 14, 1878; Braithwaite, July, 1881.

"Accumulatious of Cerumiuous and Sebaccous Secretions and Epidermis and Foreign Bodies in the External and Auditory Meatus," R. Siuclair: Edinburgh Med. Jour., XXVI., 988, 1880-81.

"A Case of Trepanation of the Mastoid Process; Death by Miliary Tuberculosis," H. Steinbrügge (trans. by W. C. Ayres): Arch. Otol., X., 31, New York, 1881.

"Behandlung af Otorrhœa," Thanlow: Norsk. Mag. für Lager, R. III. x.

"Suggestions Regarding the Treatment of Suppurative Otitis," S. Theobald: New York Med. Rec., Aug. 20, 1881.

"Circumscribed Desquamative Iuflammation of the External Auditory Meatus," Weil: Ediuburgh Med. Jour., Aug., 1881.

"A Body-Louse Causes Tinnitus Aurium," A. D. Williams: Med. Brief, St. Louis, Sept., 1881.

Middle Ear.

"Ke voprosu ob iskusstvenomme vvedenii gazoobrazniche i jidkiche veshestve ve barabanuuion poloste chereze Evstachievn trubu" (Iujection of

Medicaments into Cavity of Tympanum), Agapitoff: Voyenno-med. J., St. Petersburg, CXL., Pt. 3, 3, 51, 83, 1881.

"Caseous Accumulations in the Middle Ear Regarded as a Probable Cause of Miliary Tubercle," T. Barr: Med. Times and Gazette, London, Aug. 27, 1881.

"Mastoid Periostitis; Value of a Free Incision," T. Barr: Glasgow Med. Jour., XV., 392, 1881.

"The Treatment of Purulent Discharges from the Ear, where the Source of the Secretion is in the Upper Part of the Tympanum and Antrum Mastoideum; with Four Illustrative Cases," T. Barr: British Med. Jour., Sept. 3, 1881.

"Ein neuer Weg für Ausbreitung eitriger Entzündung aus den Räumen des Mittelohrs auf die Nachbarschaft und die in diesen Falle einzuschlagende Therapie," F. Bezold: Dtsch. med. Wchsch., July 9, 1881.

"Die diagnostische und therapeutische Bedeutung der Lufteintrebungen im Mittlelohr," A. Bing: Allg. Wien. med. Zeitg., Aug. 2, 1881.

"A Case of Rupture of the Tympanum, with Paralysis of the Face," G. M. Booth: British Med. Jour., I., 922, London, 1881.

"Small Vascular Tumors of the Membrana Tympani," A. H. Buck: New York Med. Rec., Aug. 20, 1881; Trans. American Otol. Soc., 1881.

"Rupture of Membrana Tympani by Slight Blow on Side of Face," J. J. Chisolm: Maryland Med. Jour., Aug. 1, 1881.

"Otorrhœa; Stoppage of Discharge; Hyperpyrexia, which Subsided after Ejection of a Small Quantity of Pus from the Ear," Clarke: Med. Press and Circular, XXXI., 551, London, 1881.

"Rupture of the Drumhead from a Box on the Ear," A. S. Core: Peoria Med. Monthly, Aug., 1881; Am. Specialist, Sept. 1, 1881; Southern Med. Rec., June 20, 1881.

"Functions of the Eustachian Tube," Fournié: New York Med. Rec., Sept. 17, 1881; Med. Times and Gazette, London, Aug. 27, 1881.

"Phlébite de la Jugulaire dans le Cours d'une Otite Moyenne; Hémorrhagie," A. Godefroy: Jour. d. Sc. Méd. de Lille, III., 392, 1881.

"Weitere Beiträge zur neuropathischen Form des Menière'schen Symptomen-Complexes," J. Gottstein: Arch f. Ohrenh., XVII., 174, Leipzig, 1881.

"Phlebitis und Thrombose des linken Sinus Transversus und Sinus Cavernosus in Folge chron. eitriger Trommelhöhlen—Entzündung des linken Ohres," L. Grossmann: Allg. Wien. med. Zeit., XXVI., 210, 1881.

"Primary Abscess of Mastoid Process," Gruening: New York Medical Record, XIX., 634, 1881.

"Epithelioma of the Middle Ear," J. C. Kipp: New York Medical Record, August 20, 1881; Trans. Am. Otol. Soc., 1881.

"Des Engorgements et de l'Ankylose des Articulations des Osselets de l'Ouïe," Ladreit de Lacharrière: Ann. des Mal. de l'Oreille, July, 1881.

"Catarrh Purulent de l'Oreille Moyenne et Externe; Polypes; Ablation à

l'Aide du Polytome de Wilde; Guérison," E. Levy: Rev. Méd. de l'Est, XIII., 273, Nancy, 1881.

"Breiträge zu den traumatischen Verletzungen des Trommelfels," K. Lichtenberg: Pest. med.-chir. Presse, XVI., 437, Budapest, 1881.

"Some Difficulties Presented in the Diagnosis, Prognosis, and Treatment of a Certain Form of Middle-Ear Deafness," P. McBride: M. Times and Gaz., London, August 27, 1881.

"A Fluid Artificial Membrana Tympani," Michelle: M. Times and Gaz., London, August 27, 1881.

"Considérations Anatomiques et Physiologiques sur la Trompe d'Eustache," C. Miot and J. Baratoux: Progrès Méd., IX., 477, 496, Paris, 1881.

"On the Value of Operations in which the Tympanic Membrane is Incised," Paquet: M. Times and Gaz., London, August 27, 1881.

"Myringodectomie par Formation d'un Lambean à Base Supérieure adhérente et à Sommet Inférieur Libre," Paquet: Bull. et Mém. Soc. de Chir., de Paris, VII., 332, 1881.

"A Modification of Myringdectomy for Sclerosis of the Ear": New York Medical Record, Sept. 17, 1881.

"Grosse Gummigeschwülste am Warzenfortsatze und in der Schläf-Enstirngegend, complicirt mit eitriger Mittelohrenzündung," J. Pollak: Heilung Allg. Wien. med. Zeit., XXVI., 209, 1881.

"The Value of Operations in which the Tympanic Membrane is Incised," D. B. St. J. Roosa: New York Medical Record, August 20, 1881; Trans. Am. Otol. Soc., 1881.

"A Brief Report of a Case of Abscess of the Mastoid Cells from the Use of the Nasal Douche," A. M. Rosebrugh: Canada J. M. Sc., VI., 206, Toronto, 1881; Canada Lancet, XIII., 362, Toronto, 1880–81.

"The Dangers of Chronic Suppuration of the Middle Ear, and their Prevention," R. Sinclair: Edinburgh Med. Jour., XXVI., 1063, 1880–81.

"Observaciones prácticas sobre el cateterismo de la trompa de Eustaquio," L. Suñé y Molist: Rev. de Cien. Méd., VIII., 212, Barcel., 1881.

"Dell' irrigazione sanguigna nella cavità del timpano e nel fondo dell' occhio nell' appliccamento," A. Tamassia: Riv. Sper. di freniat., Reggio-Emilia, VII., pt. 2, 1, 1881.

"Atropia in Acute Middle-Ear Inflammation," S. Theobald: Louisville Med. News, June 4, 1881.

"Healing of Perforations in the Membrana Tympani," S. Theobald: Trans. Am. Otol. Soc., 1881.

"Concerning Two Cases of Perforation of the Membrana Tympani from Ascaris Lumbricoides; with Remarks upon the Curious Habits of this Human Parasite," C. S. Turnbull: Med. and S. Rep., Philadelphia, July 9, 1881.

"Inflation of the Middle Ear," C. H. Vilas: Clinique, II., 209, Chicago, 1881.

"Zur Behandlung der Mittelohreiterung," Walb: Dtsch. med. Wochsch., July 30, August 6, 1881.

"Otitis Media Chronica mit Serösen Secrete in der Pankenhöhle und in den Zellen des Proc. Mastoid. bei imperforirtem Trommelfelle; Sinusthrombose und Meningitis; Tod.," E. Zaufal: Arch. f. Ohrenh., XVII., 157, Leipzig, 1881.

"Ueber die Folgen von Durchsteigerung in der Pankenhöhle und die Function der Bogengänge," B. Bajinsky: Arch. f. Anat. u. Physiol., Abth. 3, 4, 1881.

"Bemerkungen über die Lymphbahnen des inneren Ohres," C. Hasse: Arch. f. Ohrenh., XVII., 188, Leipz., 1881.

"Ueber die histologischen Veränderungen in Knochen und in den Weichtheilen des nittleren und inneren Ohres bei Caries des Felsenbeines," S. Moos and H. Steinbrügge: Ztschr. f. Ohrenh., X., 2.

"Fernere Beobachtungen über die histologischen Veränderungen des Labyrinthes bei der hämorrhagischen Pachymeningitis," S. Moos and H. Steinbrügge: Ztschr. f. Ohrenh., Wiesb., X., 102, 1881.

"Noch einige Worte zur Frage der Function der halbkreisförmigen Canäle des Ohres," C. Spamer: Arch. f. d. ges. Physiol., XXV., 177, Bonn, 1881.

"On Acute, Subacute, and Chronic Purulent Inflammation of the Middle-Ear," L. Turnbull: Medical Bulletin, Philadelphia. September, 1881.

Miscellaneous.

"On the Removal and Reproduction of the Eustachian Tube in the Treatment of Ear Diseases," A. W. Adams: Rocky Mountain Medical Review, July, 1881; Cincinnati Lancet and Clinic, August 27, 1881.

"On Certain Anatomical Relations between Abscess of Brain and Aural Disease," J. A. Adams: Glasgow Medical Journal, XV., 417, 1881.

"Transactions, Fourteenth Annual Meeting, American Otological Society," New York Medical Record, July 30, 1881.

"Hygiene of the Ear," W. R. Amick: San. News, I., 97, Hamilton, O., 1881–82.

"Aural and Laryngeal Head-Mirror," Anonymous: New York Medical Record, XX., 52, 1881.

"Reflex Neuralgia: a Case Caused by a Foreign Body in the Ear," G. F. Arney: Medical Bulletin, III., 152, Philadelphia, 1881.

"Report on Ophthalmology and Otology, Ohio State Medical Society," S. C. Ayres: Ohio Med. Jour., July, 1881.

"Traumatisme du Voisinage de la Trompe d'Eustache par un Tuyau de Pipe; Catarrhe Purulent de l'Oreille; Polype Consécutif," J. Baratoux: Rev. mens. de Laryngol., etc., I., 84, 89, Bordeaux, 1880–81.

"Pathologie et Thérapeutique Générales de l'Oreille," J. Baratoux: Rev. Mens. de Laryngol., etc., I., 218, Bordeaux, 1880–81.

"Pathologie et Thérapeutique Générales de l'Oreille." J. Baratoux: Rev. Mens. de Laryngol., etc., I., 235, 283, Bordeaux, 1880–81.

"The Importance of a Knowledge of Diseases of the Ear to the Student and General Practitioner of Medicine," T. Barr: Glasgow Med. Jour., XV., 23, 1881.

"The Study of Aural Surgery," T. Barr: Brit. Med. Jour., Sept. 3, 1881.

"Nuove cause della cofosi," D. Bartolozzi: Sperimentale, XLVII., 459, Firenze, 1881.

"Ueber Simulation von Ohrenkrankheiten," Becker: Jahresb. d. Gesellsch. f. Nat. u. Heilk. in Dresd., 63, 1880–81.

"Ueber ein Einfluss der Nerven der Pankenhöhle auf die Sekretion ihrer Schleimhaut," E. Berthold: Tagebl. d. Versamml. deutsch. Naturf. u. Aertzte, LIII., 257, Danzig, 1880.

"Selection of Test-Words according to their Logographic Value," C. J. Blake: New York Medical Record, August 20, 1881; Trans. Am. Otol. Soc., 1881.

"The Affections of the Ear Accompanying Infectious Diseases," L. Blau: Internat. Jour. Med. and Surg., I., 337, New York, 1881.

"Ueber die Antiseptische Behandlung der Ohrenkrankheiten," J. Böke: Pest. med.-chir. Presse, XVII., 249, Budapest, 1881.

"Note sur une Cause peu connue de Bourdonnements de l'Oreille," M. Boudet: Gaz. Méd. de Paris, 6, S. III., 108, 1881.

"Transactions of Subsection of Otology at the Annual Meeting, British Medical Association": British Med. Jour.. Sept. 3, 1881.

"Sudden and Complete Loss of Hearing during an Attack of Mumps," A. H. Buck: New York Med. Rec., Aug. 20, 1881; Trans. Otol. Soc., 1881.

"Bericht über die im Jahre 1880 in meiner Poliklinik für Ohrenkranke beobachteten Krankheitsfälle," K. Bürkner: Arch. f. Ohrenh., Leips., XVII., 181, 1881; Nachr. v. d. k. Gesellsch. d. Wissensch. u. d. Georg-Aug. Univ., Götting., 78, 1880.

"Malignant Growth in the Naso-Pharynx, with Early Aural Symptoms," C. H. Burnett: New York Med. Rec., Aug. 20, 1881; Trans. American Otol. Soc., 1881.

"A Glaring Defect in the Treatment of Aural Cases by some Physicians," J. J. Chisolm: Maryland Med. Jour., Aug. 15, 1881.

"How to Test the Hearing," M. F. Coomes: Med. Herald, III., 21, Louisville, 1881–82.

"Ear-Protector," W. Cousins: British Med. Jour., Sept. 3, 1881.

"Zur Antisepsis in der Ohrenheilkunde, ein antiseptisches Tympanum artificiale," G. Czarda: Wien. med. Presse, XXII., 632, 665, 1881.

"Fracture de la Base du Crâne compliquée d'Hémorrhagie par le Conduit Auditif Externe, avec Intégrité du Tympan," Delstanche et Stocquart: Jour. de Méd. de Bruxelles, Jan., 1881.

"De la Surdité et de la Cécité Verbales," L. Dreyfus Brisac: Gaz. Hebd., Paris, July 29, 1881.

"Skin-Grafting in Aural Practice," E. T. Ely: New York Med. Jour., XXXIII., 694, 1881.

"Nerve-Lesion—Deafness," Gellé: Med. Times and Gaz., Aug. 27, 1881.

"Ueber die Herstellung demonstrative Präparate menschlicher Gehörknochelchen zu Vorlesungzwecken," L. Gerlach: Sitzungsb. d. phys.-med. Soc. im Erlang., XII., 4, 1879.

"Ueber das Vorkommen von Zwei Ampullen an dem äusseren (horizontallen) Bogengang des Knöchernen Labyrinthes," L. Gerlach: Sitzungsb. d. phys.-med. Soc. zu Erlang., XII., 8, 1879–80.

"Ueber das Offenhalten des Mundes bei Schwerhörigen," J. Gruber: Monatschr. f. Ohrenh., XV., 77, Berlin, 1881.

"The Hypothetical Auditory Tract in the Light of Recent Anatomical Observations," G. M. Hammond: Jour. Nerv. and Ment. Dis., New York, July, 1881.

"Notes of a Case of Lodgement of Insects in the Ear," J. A. Hardy: Austral. Med. Jour., N. S., III., 7, Melbourne, 1881.

"Fatal Otitis," G. C. Harlan: Phil. Med. Journal, Aug. 27, 1881.

"Affections of the Ears in Enteric Fever," Hasseler: Ann. des Mal. de l'Oreille, November, 1880.

"Talma's Tonometer en Zijul eerste vericht," S. R. Hermanides: Nederl. Tijdschr. v. Geneesk., XVII., 245, Amst., 1881.

"Das Nervensystem und die Sinnesorgane der Medusen," O. and R. Hertwig: Monographisch dargestelt, Taf. I.–X., Leipzig, 1878.

"An Interesting Case of Deafness," Hines: New York Med. Rec., XIX., 644, 1881.

"Ménière's Disease Cured by Quinine," J. W. H. Holland: Louisville Med. News, XII., 40, 1881.

"Earache," A. Jacobi: Southern Med. Rec., July 20, 1881.

"The Prevention of Dumbness in those Cases where it Follows Loss of Hearing," A. Kinsey: Med. Times and Gaz., London, Aug. 27, 1881.

"Schussverletzung des Ohres mit Ausfluss von Liquor cerebro-spinalis," R. Koerner: Arch. f. Ohrenh., XVII., 195, Leipzig, 1881.

"Sordera; sus grados, causas y differentes aparatos recientemente preconizados para disminuir sus inconvenientes," Ladreit de Lacharrière (trans. by E. Moresce, from Ann. d. Mal. de l'Oreille et du Larynx, Par.): Andalucia med., VI., 33, 58, Córdoba, 1881.

"On Some of the Consequences of Neglected Otorrhœa," J. A. Lippincott: Pittsburg Med. Journal, L., 195, 1880–81.

"On the Advantages of Nasal Inspection in Some Cases of Difficult Catheterization of the Eustachian Tube," Loewenberg: Med. Times and Gaz., London, Aug. 27, 1881.

"Physical Diagnosis of Affections of the Acoustic Apparatus with Healthy Middle and Outer Ears," Lucae: Med. Times and Gaz., London, Aug. 27, 1881.

"Ueber Ohrenkrankheiten bei Febris recurrens." Luckhan: Arch. f. path. Anat. u. Physiol. u. f. klin. Med., LXXXII., 1, 1880.

"Four Enucleations of the Ear," I. A. E. Lyons: American Pract., Louisville, June, 1881.

"Anomalies of Taste in Ear Disease," P. McBride: Edinburgh Med. Jour., XXVI., 902, 1880–81.

"Treatment of Aural Polypi by Rectified Spirits," P. McBride: Edinburgh Med. Jour., XXVI., 900, 1880–81: Braith., July, 1881; Half-Yearly Comp. Med., July, 1881.

"Nervous Deafness," P. McBride: Lancet, London, July 30, 1881.

"Forslag om at Oprette et Dörstumme-Institut i Jytland," R. Malling-Hansen: Kibenhavn, 1880.

"La surdité Verbale," A. Mathieu: Arch. Gén. de Méd., CXLVII., 582, Paris, 1881.

"Diseases of the Ear in Engineers and Firemen," S. Moos: Zeitsch. f. Ohrenh.. IX.; Half-Yearly Comp. Med., July, 1881; Am. Jour. Med. Sc., July, 1881; Edinburgh Med. Jour., April, 1881.

"Surgical and other Cases of Diseases of the Eye, Ear, Throat, and Nose," F. L. Parker: Trans. S. C. Med. Assoc., 1881.

"Diathetic Symptoms Developed in Connection with Pierced Ears," M. C. Paul: L'Abeille Méd.; Cincinnati Lancet and Clinic, May 21, 1881.

"De Quelques Causes Habituelles des Maladies des Oreilles" (from Gaz. Méd. de l'Algérie, 1880), Pejé: Rev. Mens. de Laryngol., etc., I., 107, Bordeaux, 1880–81.

"Action of Syphilis on the Ear," F. M. Pierce: Med. Times and Gaz., London, August 27, 1881.

"Ein kleines Instrument für Schwerhörige." A. Politzer: Wien. med. Wchnschr., XXXI., 505, 1881.

"Aural Surgery as a Branch of Medical Education. An Address delivered in the Subsection of Otology of the British Medical Association," U. Pritchard: British Med. Jour., Sept. 3, 1881.

"Heveny izületi lob utani fülideglüidés tökelétes süketség (Paralysis of Auricular Nerve)," J. Reisz: Gyógászat, XXI., 337, Budapest, 1881.

"Otitis; Abscess of the Middle Crus Cerebri," Robertson: Australian Med. Jour., April 15, 1881.

"The Tuning-Fork in Diagnosis," D. B. St. J. Roosa: Med. Rec., August 20, 1881; Trans. Am. Otol. Soc., 1881.

"The Evil Consequences of Neglected Colds in the Head," D. B. St. J. Roosa: Trans. Med. Soc. State of New York, 1880.

"Oprettelsen af et Dörstumme-Institut i Jytland," L. W. Salomonsen: Ugeskrift for Läger, IV., 1, 174.

"The Aural and Laryngeal Mirror—a Question of Priority," F. Semeleder: Medical Record, September 10, 1881.

"The Japanese Otacoustic Fan," S. Sexton: Boston Med. and Surg. Jour., July 7, 1881; New York Medical Record, Sept. 30, 1881.

"The Effect on the Ear of High Atmospheric Pressure in Tunnel-Construction," S. Sexton: New York Medical Record, July 30, 1881.

"Flexible Eustachian Catheter," S. Sexton: Trans. Am. Otol. Soc. 1881; New York Medical Record, XX., 82, 1881.

"Diplacusis Binauralis; Eine Selbstbeobachtung," J. A. Spalding (Uebersetzt von H. Steinbrugge): Ztschr. f. Ohrenh., X., 143, Wiesb., 1881.

"Ueber ein eigenthümliches Verhalten des Pflasterepithels der endolymphatischen Räume des Menschens," H. Steinbrugge: Zeitsch. f. Ohrenh., X., 109, Wiesb., 1881.

"On Certain Conditions of the Eyes as a Cause of Loss of Hearing by Reflex Irritation," H. Stevens: Med. Times and Gaz., London, August 27, 1881.

"Higiene del oido," L. Suñe y Molist: Higiene para Todos, I., 35, 49, 66, 74, Barcel., 1881.

"Surdité survenant chez les Employés des Chemins de Fer," Terillon: Rev. de Chir., Paris, 1881.

"De l'Otite Scléreuse chez les Employés de Chemins de Fer," Terillon: La France Méd., July 10, 1881.

"Diseases of the Ear in Railroad Conductors, Locomotive Firemen, and Engineers," L. Turnbull: College and Clin. Rec., June 15, 1881.

"Reminiscences of a Visit to Europe in 1879," L. Turnbull: Med. and Surg. Rep., Philadelphia, Sept. 18, 1881.

"Ueber des an—u. Anklingen akustichen Empfindungen," J. Urbantschitsch: Wien. med. Pr., May 29, 1881.

"Otoscopo prensor del Dr. Verdos," Verdos: Rev. de Med. y Cir. Pract., Madrid, IV., 90.

Acústica biológica, modificaciones del poder transmisor del sonido en los téjidos afectos de Reumatismo," P. Verdos: Gac. Méd. Catal., I., 229, 276, Barcel., 1881.

"The Use of Electricity in Ear Disease," E. Woakes: British Med. Jour., July 16, 1881.

"Paretic Deafness," E. Woakes: Med. Times and Gaz., July 16, 1881.

"Jahresbericht der otiatrischen Klinik des Prof. Dr. Zaufal," Zaufal: Aerztl. Ber. der K.K. Allg. Krankenh. zu Prag., 275 (1878), 1880.

Acoustics.

"Upon the Production of Sound by Radiant Energy," A. G. Bell: Silliman's Jour., June, 1881.

"Ueber den Ursprung und Stosstöne bei harmonischen Intervallen," R. Koenig: Wiedemann's Annal., 3, p. 335, 1881.

"Beschreibung eines Stosstöneapparates für Vorlesungsversuche," R. Koenig: Wiedemann's Annal., 3, p. 250, 1881.

"Note sur l'Application du Diapason a l'Étude de la Propagation du Son et des Mouvements Vibratoires dans les Liquides," C. Montigny: Bull. de l'Acad. Roy. des Sci. de Belg., 12, p. 800, 1880.

"On the Conversion of Radiant Energy into Sonorous Vibration," W. H. Preece: Telegraphic Jour., April 1, 1881.

"On the Way Sound-Waves Reach the Auditory Apparatus," Sapolini: Med. Times and Gaz., London, August 27, 1881.

NOTES.

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